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Blake p 309.

2 parts in 1 vol.

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THE ANATOMY OF THE *Human Bones and Nerves:*

WITH

An Account of the reciprocal
Motions of the HEART,

AND

A Deſcription of the HUMAN
LACTEAL SAC and DUCT.

By ALEXANDER MONRO, *Profeſſor of*
Anatomy in the Univerſity of Edinburgh,
and F. R. S.

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TO THE
Students of Anatomy
IN THE
Univerſity of EDINBURGH;

GENTLEMEN,

WHEN I firſt engaged to publiſh an Oſteology, *I had no near View of your being favoured with Treatiſes on the ſame Subject by ſo many great Maſters in Anatomy as have wrote ſince that Time. Had I known that* Albinus, Winſlow *and* Palfyn *were to have publiſhed Deſcriptions of the human Bones, my Papers probably would have remained yet undelivered to the Printers: I however flatter myſelf, that this* Eſſay *has* *been of Uſe to the Gentlemen who did me the Honour to attend my Colleges, by aſſiſting them to underſtand my Senſe and Repreſentation of Things in this fundamental Part of Anatomy; and that it has poſſibly been of more Advantage to them than a more complete Work from an abler Hand, unleſs my Demonſtrations had been in the Order and Method of ſuch an Author.*

This View of your Improvement, Gentlemen, is a prevailing Argument with me, to cauſe this Eſſay to be reprinted, and you cannot reaſonably blame me if I likewiſe acknowledge a ſelfiſh Motive for it. In a new Edition an Author has an Opportunity of making his Works more correct, complete, and conſequently acceptable to the Publick, who may perhaps be indulgent enough to think this little Treatiſe not altogether uſeleſs, ſince more Reaſoning on the Structure and morbid Phænomena of Bones is to be found in it, than in the other Writers, who have confined themſelves almoſt entirely to the deſcriptive or proper anatomical Part of the Oſteology.

I have here kept to the Plan of the former Editions, by firſt conſidering, in the Order that ſeemed to me moſt natural and methodical, all the Particulars which I thought neceſſary to be known concerning

Bones in general; and in the ſecond Part, I have deſcribed the ſeveral Bones compoſing the Skeleton.

The full grown Bones are what I principally endeavour to deſcribe, but I have added as much of the Oſteogenea, *as I think ſerviceable in the Practice of Phyſick and Surgery.*

That little might be omitted of what was formerly done on this Subject, I have taken all the Aſſiſtance I could from Books, but have never aſſerted any anatomical Fact on their Authority without conſulting the Life, from which all the Deſcriptions are made; and therefore the Quotations from ſuch Books, ſerve only to do Juſtice to the Authors, who have remarked any Thing in the Structure of the Parts that was commonly omitted, and to initiate you in the Hiſtory of Anatomy, which I once propoſed to make complete, ſo far as related to this Subject; but not being able to procure ſeveral Books, and being ſenſible how many more may have never come to my Knowledge, I laid aſide this Deſign, of Purpoſe omitted many I could have inſerted, and in ſome Places changed an older Author for a later one, who has more fully or clearly deſcribed what I treated of. Beſide Anatomiſts, I have alſo named ſeveral other Authors

thors to confirm my reaſoning by practical Caſes, of which it is not to be ſuppoſed my Experience could furniſh a ſufficient Variety. You'll readily obſerve, that I quote no Paſſages with a View to criticiſe or condemn them. This Precaution of giving no Offence, is very neceſſary in thoſe who are ſufficiently conſcious of their being liable to lay themſelves open to juſt Cenſure; and it prevents Occaſions of uſeleſs Wrangling, in which generally both Parties are Loſers, and the Publick has little Advantage.

In this Treatiſe, I always make uſe of the moſt common Name of each Part, and have put the ſynonimous Names to be met with in Books at the Foot of the Page, that the reading might be ſmoother, and you might conſult them at your Leiſure, to aſſiſt you in underſtanding different Authors.

The Deſcriptions and Reaſoning are here blended, without which I always find younger Anatomiſts ſoon are diſguſted with Authors; their Imaginations cannot follow a long Chain of Deſcriptions, eſpecially when they are not taught at the ſame time the Uſes the deſcribed Parts ſerve: Their Minds muſt have ſome Relaxation by a Mixture of Reaſoning, which never miſſes to ſtrike the Fancy agreeably, and raiſes a *ſtrong Deſire to underſtand the Principles on which it depends.*

The Phænomena *of Diſeaſes are all deduced in this Eſſay from the Structure of the Parts, by Way of Corollaries and Queſtions, which ſuch an anatomical Work confined me to; and this Method has otherwiſe a good Effect: For when one meets with an uſeful Propoſition, and is obliged to employ a little Thought to find out its Solution, the Impreſſion it makes is deeper, and he acquires a Fondneſs of it, as being in Part his own Diſcovery. My Pupils have frequently aſſured me, they could with very ſmall Reflexion, trace out the whole Reaſoning from which my Concluſions were drawn; I hope their Succeſſors will alſo think this an agreeable Manner of being inſtructed. Thoſe Gentlemen who deſired I would add the Lectures I pronounce in my Colleges as a Commentary upon the Text where the Diſeaſes are mentioned, will, I perſwade my ſelf, excuſe me for not complying with their Deſire, when they conſider the Deſign of this is to be a School-Book, and how great the Difference is between inſtructing Youth in private, and pretending to inform the Publick.*

In this Edition, I have corrected the Miſtakes and obſcure Paſſages which I diſ-

covered in the former, and in ſome Places I have made the Deſcriptions more full and exact, aiming all I could to ſhun unneceſſary Minuteneſs on the one Hand, and a blameable Inaccuracy on the other: Whether I have hit that juſt Medium, is what you and the Publick muſt now judge.

I am ſtill of Opinion that Figures of the Bones would at any Rate have been unneceſſary in a Book that is intended to be illuſtrated and explained by the Originals themſelves, but would be much more ſo now when my ingenious Friend Mr. Cheſelden *has publiſhed ſuch elegant Ones; and, if I am rightly informed, Doctors* Trew *and* Douglas *are ſoon to publiſh others.*

The advantageous Opportunities you have in this Place of ſtudying all the different Branches of Medicine under the proper Profeſſors in the Univerſity, and of ſeeing the Practice of Pharmacy, Surgery and Phyſick, with our Surgeon-Apothecaries and in the Infirmary, which muſt ſoon be fit for accommodating a conſiderable Number of Patients and Students; theſe Opportunities, Gentlemen, which your Intereſt, and I hope, your Inclinations, lead you to improve, will probably prove a happy Means of your making a conſiderable Figure in your ſeve-

ſeveral Stations: Whatever Aſſiſtance is in my Power towards ſuch a deſirable Event, ſhall be given with the greateſt Pleaſure by,

Your humble Servant,

ALEX^{r}. MONRO.

Errors of the Preſs.

Page.	*Line.*	*for*	*read.*
10	33	is	are.
ibid.	34	ſcarcs	ſcarce.
25	3	Reſiſtence	Reſiſtance.
47	12	Property	Propriety.
68	12	Tex-	Texture.
71	2	fonnd	found.
80	11	Ethomoides	Ethmoides.
81	35	Noiſe	Noſe.
85	1	ſagtital	ſagittal.
87	19	ſphenodal	ſphenoidal.
92	26	additamentm	additamentum.
93	2	tempokum	temporum.
94	23	inferio	inferior.
96	29	tympannm	tympanum.
103	28	tke	the.
115	9	Euſtachinana	Euſtachiana.
135	22	the the	the.
146	ult.	Letter ,	Letter *v*,
152	8	Carrilrges	Cartilages.
303	10	Aſtraguluns	Aſtragalus.

THE ANATOMY OF THE *Human Bones.*

PART I.

Of the Bones in general.

PERIOSTEUM.

BEFORE we can underſtand the Structure of the Bones, we muſt be acquainted with the Texture of a Membrane, which is contiguous to moſt of them, and from its Office of covering them is called *Perioſteum**.

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* *Membrana circumoſſalis, omentum oſſibus impoſitum.*

Fibres. At firſt View, the *Perioſteum* appears a ſimple Compact Subſtance; but when recent, and ſtill more when macerated in tepid Water, it is diviſible into Layers; as indeed much finer and more ſubtile Membranes are: Therefore this Circumſtance would not be worth remarking, was it not that the innermoſt Layer of Fibres ſeems to be conſtant, uniform, and diſtinct from all the others of which the *Perioſteum* is compoſed; for it is never wanting, and its Fibres being commonly in the ſame Direction with the bony Fibres under it, are for the moſt part parallel one to another.

Some Authors are at Pains to prove this internal Layer of the *Perioſteum* to be derived from the *dura Mater*: For, ſay they, ſince the Membrane covering the Scull is plainly a Production or Continuation of the *dura Mater*, which paſſes out between the Sutures; and ſince there are Muſcles on the Head, as well as in other Parts, which might furniſh a *Perioſteum*, 'tis needleſs to aſſign different Origins to Membranes which have the ſame Texture and Uſes. Nay *Havers (a)* adds further, in proof of this Doctrine, (and his Obſervation generally is true,) that he can demonſtrate the *Perioſteum* to be continued from one Bone to another, by proſecuting and raiſing it from the Ligaments which cover the Articulations. The great Deſign of all this arguing is, to ſupport a Hypotheſis, which prevailed a conſiderable Time, of all Membranes being derived from one or other of the two that cover the Brain; otherwiſe it is to no Purpoſe to diſpute, whether the *Perioſteum* is a Production or Continuation of the *dura Mater*, or if it ought to be eſteemed a diſtinct Membrane, ſo long as we rightly underſtand its Structure and Uſes.

(a) Oſteolog. nov. Diſc. 1.

The other *Strata* or Layers, of which the *Perioſteum* is compoſed, are all derived from the Muſcles; and their Fibres have different Directions, according to the Courſes of theſe Muſcles. This may be plainly perceived, when one ſeparates ſome of the exterior muſcular Fibres that are inſerted into the *Perioſteum*; for they may be traced on this Membrane, till after loſing their muſcular Appearance, they are intimately blended with its other Fibres, and enter into its Compoſition: And in tearing a Piece of the *Perioſteum* when dried, the Diſpoſition of theſe Fibres may be diſcovered, by the Membrane's yielding more eaſily when pulled according to the Courſe of the adjacent muſcular Fibres, than when an Attempt is made to tear it tranſverſely. Since then the Bigneſs, Number and Diſpoſition of the Muſcles, in reſpect of different Bones, or of the ſeveral Parts of the ſame Bone, are various, the Thickneſs of this Membrane muſt alſo be different. Hence we obſerve the *Perioſteum* thick and ſtrong in one Part, and much thinner and weaker in another.

Proceſſes.

The external Surface of this Membrane, where Muſcles are not inſerted, is very ſmooth and equal, the cellular Membrane, by which it is looſely connected to the ſurrounding Parts, readily collapſing as ſoon as it is cut; but the Side of the *Perioſteum* next to the Bone is rough and unequal, a great many Fibres being produced from it to enter into the Pits and Furrows of the Bones. Theſe Proceſſes are principally compoſed of ſmall Veſſels, lodged in *Veſſels.* an exceeding thin cellular Subſtance; as plainly appears, when we ſeparate the *Perioſteum* from a Bone, after a ſucceſsful Injection of the Arteries: For *Arteries.* then innumerable Branches of Veſſels are to be ſeen every where on the Membrane *; and the Proceſſes, which formerly appeared in the Form of very ſmall white Threads, are filled with the injected Liquor; and after they are broken, their Orifices are ſeen like ſo many coloured Points on the Surface of the Bone.

The Veins correſponding to theſe Ar- *Veins.* teries are generally to be ſeen in Subjects that die with their Veſſels full of Blood, tho' ſuch numerous Ramifications of them cannot be demonſtrated as of the Arteries, the Veins being incapable of allowing an injected Liquor to paſs from their Trunks into their minute Branches.

The great Senſibility with which *Nerves.* practical Authors affirm the *Perioſteum* to be endued, is a ſufficient Proof that it is well provided with Nerves, tho' they are too ſmall to be traced upon it; and therefore one cannot well determine, whether they are ſent along with the Arteries in the common Way, or are derived from the tendinous

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* *Ruyſch* Epiſtol, 5, Tab. 5, fig. 1. 2. Epiſt. 8, Tab. 9, Fig. 1, 6,

Fibres of the Muſcles expanded on the *Perioſteum.* Whichſoever of them it is, the racking Pain with which People are tortured, when labouring under the deep-ſeated kind of *Paronychia*, or under *Exoſtoſes*, *Nodi*, *Tophi* and *Gummata* from a *Lues Venerea*, gives a dire Conviction of the Exiſtence of ſuch Nerves.

By the frequent Furrows and Pits of the Bones, the Surface of the *Perioſteum*, which inſinuates itſelf every where into them, is much enlarged; and therefore a greater Number of Veſſels are more conveniently diſtributed to the Bones, and their Coheſion with this Membrane muſt be ſtronger.

Perforation. Beſides the Veſſels which paſs through the *Perioſteum* to the Subſtance of the Bones, there are others that perforate this Membrane, and are proper to the Marrow; of which more hereafter. And frequently the Muſcles pierce through the *Perioſteum* to their Inſertion in the Bones.

The chief Uſes of the *Perioſteum* are:

Uſes. 1. To allow the Muſcles, when they contract or are ſtretched, to ſlide eaſily; and thereby alſo to prevent the Bones and Muſcles waſting each other, which muſt have happened, had not this ſmooth Membrane been interpoſed. 2. To keep in due Order, and to ſupport the Veſſels in their Paſſage to the Bones. 3. By being firmly braced on the Bones, to aſſiſt in ſetting Limits to their Increaſe, and to check their Overgrowth. 4. To ſtrengthen the Conjunction of the Bones with their *Epiphyſes*, Ligaments and Cartilages, which in young Creatures are eaſily ſeparated when this Membrane is taken away. 5. To afford a convenient Origin and Inſertion to ſeveral Muſcles which are fixed to this Membrane. And *Laſtly*, As all other ſenſible Parts, to warn us when any Injury is offered to the Parts it covers, which, being inſenſible, might otherwiſe be deſtroyed without our Knowledge, or endeavouring to procure a Remedy.

Diſeaſes. When the cellular Subſtance connecting the *Perioſteum* to the ſurrounding Parts is deſtroyed, theſe Parts are fixed to that Membrane, and loſe the ſliding Motion they had upon it; as we ſee daily in Iſſues, or any other tedious Suppurations near a Bone. When the Veſſels which go from the *Perioſteum* to the Bones are broke or eroded, a Collection of their Liquids is made between the Membrane and Bone, which produces a ſordid Ulcer or rotten Bone. This often is the Caſe after Inflammations of the *Perioſteum*, or after *Small Pox*, Spotted Fevers, and Fractures.

BONES. As ſoon as this Membrane is removed, we diſcover the Subſtance of the BONES, which are the hardeſt moſt ſolid Parts of the Body, and generally of a white Colour, (as all other Parts are, where large Veſſels do not enter;) only in a living Creature they appear bluiſh, which is owing to the Blood in the ſmall Veſſels under their Surface. The leſs therefore and fewer the Veſſels are, and the thicker and firmer the bony Surface covering the Veſſels is, the Bones will appear whiter. Hence the Bones of Adults are whiter than thoſe of Children, and in both Young and Old the white Colour of different Bones, or of the ſeveral Parts of the ſame Bone, will always be in Proportion to their Veſſels and Solidities; which Circumſtances ought to be regarded by Surgeons, when they are to judge of the Condition of Bones laid bare.

The Bones are generally eſteemed inſenſible, and juſtly enough too; tho' there are ſome few extraordinary Obſervations handed down, which, if accurately made, would ſeem to contradict this Opinion, or at leaſt to prove that the Bones, under ſome certain Circumſtances, may become ſenſible. Witneſs the Caſe related by *Nicolaus Maſſa (a)*, of a ſordid Ulcer of the Bone of the Leg, that was attended with moſt violent Pain on the leaſt Touch of the Bone with a rough Inſtrument, tho' the *Perioſteum* was all ſeparated; nor could the Patient bear the Application of any ſuch Inſtrument after the Bone was perforated.

Plates.

The Bones are compoſed of a great many *Laminæ* or *Plates* *, which are made up of Fibres or Strings laid in a convenient Order and Number, and united by ſmaller Fibrils, or *Appendiculæ filamentoſæ* of *Malpighius (b)*; which being irregularly diſpoſed, and interwoven with the other larger Fibres, make a reticular Work.

That the *Plates* of the Bones are compoſed of ſuch Fibres, ſeems at leaſt probable from the Analogy of the Subſtances that reſemble Bones moſt; ſuch as, Whalebone, or Horns, in which this fibrous Texture is evident. Then a ſtrong Preſumption of ſuch a

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(a) Lib. Introduct. Anat. cap. 30.
* Squamæ, Bracteæ.
(b) Anat. Plant. & oper. poſthum.

Texture may be inferred, upon obſerving that Chinks made in Bones long expoſed to the Weather, or calcined in the Fire, are generally diſpoſed in the Direction which the longitudinal Fibres are found to have. Perhaps nice accurate Obſervations of the different Times that a Bone laid bare, and the Extremity of an amputated Bone, would take to exfoliate, might bid fair to determine the proportional Force of Coheſion which the Particles of the longitudinal Fibres have one to another, in reſpect of that Power by which the Fibres are connected to each other; or in other Words, the Strength of the longitudinal Fibres compared to the tranſverſe. But to put this Structure of the Bones paſt Diſpute, let us examine a *Fœtus*, in which the Bones are but a little advanced, and we ſhall diſtinctly ſee theſe bony Fibres, and can ſeparate the Plates. Nay even in old Bones, after they have been any conſiderable Time expoſed to Sun and Rain, whereby their Texture becomes more unravelled, or when they have been tortured by the Fire, and in ſome morbid Caſes, we can divide the firmeſt Bones into *Plates*, and can obſerve the Fibres of each.

Claviculi. Theſe Plates are ſaid by *Gagliardi* (*a*) to be firmly conjoined, by the Means of an infinite Number of *Claviculi*, or ſmall bony Proceſſes, which riſing from the interior *Lamellæ*, pierce thro' ſome, and are fixed into others of the more external Plates. Of theſe bony Nails, he has deſcribed and painted four different Species, which,

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(*a*) Anat. oſſium nov. invent. illuſtrat. cap. 1. Obſ. 2.

which, he affirms, are moſt conſpicuous in the Bones of the Head, after they have been ſo prepared by long boiling, burning, or expoſing to the open Air, that their Plates will ſeparate with little Violence. The *Claviculi*, which riſe up ſtreight, and terminate in a ſmall Point, he calls *perpendicular.* *Perpendicular.* If ſuch *conoid* Nails riſe ſlanting, *Oblique.* he names them *oblique.* If the *Clavicles* ſtand perpendicular, but become larger at their Extremities, he ſtiles them *capitati* or *headed.* *Headed.* If they appear oblique but crooked towards their Point, the Name he gives them, is *ad angulum retorti* or *crooked.* *Crooked.*

After the *Claviculi* are thus claſſed with diſtinguiſhing Names, *Gagliardi (a)* endeavours to ſhew how they are differently formed, and mentions ſome analogous Experiments he made to illuſtrate his Theory; concluding the Account of them with his Reaſons for this Mechaniſm of the Bones ſerving better than any other, the Deſign of keeping the Plates firmly united; and obviating a Difficulty might be propoſed, of an Inconvenience happening from thoſe Nails which pierce the moſt external Plate hurting the *Perioſteum* and even the Muſcles, when preſſed ſtrongly againſt the Bones; for all this, he ſays, is prevented, becauſe the *Claviculi* never riſe above the Surface of the Bones.

This Hiſtory of the *Claviculi* may perhaps be true, but it is more than I can vouch: For tho' after ſeparating the *Laminæ* of ſome Bones, duly prepared, I could, with the help of a Microſcope, eaſily ſee a great Number of Inequalities or little Proceſſes riſing out from the Plates, yet I could never diſcover theſe Figures, Shapes or Situations which *Gagliardi* aſſigns them; nor do I know any other Anatomiſt who pretends to have ſeen or to demonſtrate ſuch bony Nails as I have deſcribed from that Author. No leſs an accurate Diſcoverer of the minute Structure of Animals than *Malpighius* *(a)*, thinks theſe nothing elſe, than ſome few of the bony Fibres riſing perpendicularly, while the greateſt Number run horizontally, and denies them to have any ſuch regular Appearance.

(a) Anat, oſſium nov, invent. illuſt. cap. 1. Obſ. 2.

Cancelli. The Sides of the Bones are compoſed of Plates thus firmly united by the ſmall Proceſſes, but their internal Subſtance is more ſpongy and cellular, the bony Fibres forming here the *Cancelli* or Lattice-work in the following Manner. All the Plates are firmly conjoined about the middle of the Bone; but as they are extended towards its Extremities, the more internal Plates ſeparate from the exterior, and ſtretch out their Fibres towards the Axis of the Bone, where they are interwoven with the Fibres of others that have been ſent off in the ſame Way; and ſeeing the Plates are thus conſtantly going off in their Courſe towards the Extremities; the ſolid Sides of the Bone muſt become thinner proportionally, and the Lattice-work muſt be thicker and ſtronger. This is very remarkable in ſome Bones, where the ſolid Sides of their middle i half an Inch thick, and the *Cancelli* are ſcarce

obſerve

(*a*) Oper. poſthum.

obſervable, whereas at their Extremities, where their Diameter is greateſt, the ſolid Walls or Sides are not thicker than Paper, and the *Cancelli* are numerous and large enough to fill up the whole Space left between the Sides.

Gagliardi (a) minutely remarks the different Appearances of theſe *Laminæ*, after they begin to ſeparate from the more external Plates to form this Lattice-work, and according to theſe Appearances, has impoſed different Names on them. As for Inſtance, when they make the firſt Turn or Wrinkle, he ſtiles them *Cancelli corrugati*, which he divides into two Sorts, from their being more or leſs wrinkled. The next Species is called *Perforati* or *Cribriformes*, becauſe the Fibres of the Plates ſeparating more, leave ſmall Holes in their Interſtices: This Sort is alſo ſubdivided. When the Fibres come to be ſo divided and interwoven as to form a Network, they obtain the Name of *Reticulares*; theſe are again diſtinguiſhed by an Epithet of *majus* and *minus*. The Twiſting and Windings which theſe *Cancelli* make, and the Interſtices which they leave, differ conſiderably in Figure, Number and Magnitude, and therefore form little Cells, which are as different, but communicate with each other, ſome by one, others by two or three Pores.

Corrugati.

Cribriformes.

Reticulares.

This cellular Texture is ſo univerſal as to take Place through the whole interior Part of the large round Bones, ſuch as the Thigh or

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(a) Anat. oſſium. cap. 1, Obſ. 4. 5. 6. 7.

Arm-Bone. For tho' Authors, in the Deſcription of theſe Bones, only take Notice of this Structure near their Extremities, and mention an uninterrupted Cavity in their middle; yet if they are carefully kept without tumbling and toſſing about, till their Marrow is exhauſted; or if they are calcined with the like Care, and then Part of the Bone is cautiouſly ſeparated, the reticular *Cancelli* may be obſerved, of a beautiful curious Texture, through the whole Extent of the Bone, eſpecially in the middle, where this Cavity is commonly ſaid to be ſeen, but compoſed of ſuch fine delicate Fibrils in this Place, as to be eaſily deſtroyed in preparing, without ſome Precaution and Care, which I imagine is the Reaſon why they have been ſo generally neglected in the Deſcriptions of Bones.

Uſes. The *Cancelli* ſuſtain the membranous Bags of the Marrow which are ſtretched upon them, and thereby hinder theſe membranous Parts to be torn or removed out of their proper Places in the violent Motions and different Poſitions which the Bones are employed in, or in the ſeveral Degrees of Diſtenſion which the Bags are brought to, by the Marrow contained in them, being increaſed or diminiſhed in its Quantity. By this Support which the *Cancelli* afford the Marrow, we may alſo ſee how the Membranes and Veſſels of this Subſtance, in the lower Extremities of the Bones, are ſaved from being compreſſed by the Weight of the Marrow in the middle and ſuperior Extremities, which would make a conſiderable Preſſure in the long perpendicular Bones.

Paſſages for the Marrow.

Beſides the Pits and Furrows on the external Surface of the Bones, which I mentioned when the *Periosteum* and the Paſſages of the medullary Veſſels were deſcribed, there are Pores paſſing outwards from the more external *Cancelli*, directly croſs the Bone, which open into other Canals, that are diſpoſed longitudinally; from which again, other tranſverſe Paſſages go out to terminate in other longitudinal Canals, and this Structure is continued all through the ſolid Subſtance of the Bone. Both theſe Sorts of Canals are numerous and large near the Lattice-work, but gradually decreaſe towards the external Surface of the Bones, as may be ſeen diſtinctly with a Microſcope, or even with the naked Eye, in a Bone burnt till it is white. 'Tis true indeed, we may, by viewing a burnt Bone, be impoſed on to believe both Sorts of theſe Canals more numerous than they really are, becauſe, as *Morgagni (a)* has remarked, the Holes made by the tranſverſe Proceſſes connecting the Plates of the Bones, will have the Appearance of tranſverſe Pores; and the Canals in which the Blood-veſſels are contained, reſemble the longitudinal. Theſe two Sorts of longitudinal Canals may, in my Opinion, be diſtinguiſhed from each other by the following Marks: The Paſſages for the Veſſels are largeſt near the external Surface of the Bones, and every tranſverſe Section of them is circular; whereas the longitudinal Canals a-

Tranſverſe.

Longitudinal.

bove

(a) Adverſ. 2, animad. 25.

bove deſcribed, are, as was already ſaid, largeſt where they are neareſt the Cavity of the Bone, and their tranſverſe Sections appear to me of a flat oval Figure; which Difference may be accounted for, by conſidering the Preſſure which all Canals ſituated between the Plates of Bones muſt ſuffer, and the great Diſproportion between the Forces by which the Fluids contained in theſe two Kinds of Canals are propelled.

In the larger Sort of both tranſverſe and longitudinal Canals, neareſt to the *Cancelli* of a recent Subject, we ſee Marrow contained, hence we have Reaſon to conclude, that it paſſes alſo into the ſmaller ones. This will appear more probable, upon ſeeing with a Microſcope, Drops of Oil every where on the Surface of freſh Bones broke tranſverſely, and after obſerving that the Marrow makes its Way through the moſt ſolid Bones, even in a dead Body, as is evident it does, from the Greaſineſs and yellow Colour, which Skeletons, tho' ever ſo clean and white at firſt, contract in a little time. Of what Advantage this Diſtribution of the Marrow through the bony Subſtance is, ſhall be conſidered, after that Animal Oil is examined.

Arteries. The Arteries derived from the *Perioſteum*, formerly deſcribed, are diſtributed through the whole Subſtance of the Bones, as is evident after a ſucceſsful Injection; and in ſawing, raſping or cutting the Bones of living Creatures, theſe Veſſels plainly diſcover themſelves by the ſmall Drops of Blood which ouze out. The Blood-veſſels are larger near each Extremity than at the middle of the large Bones that are much moved, becauſe near the Extremities, they not only ſerve the Bones, but paſs through them to the Marrow. Theſe Veſſels of the Bones ſometimes become very conſpicuous, if Obſervators have not miſtaken: A remarkable enough Inſtance of this, is *Diemerbroek*'s (*a*) Obſervation of an Artery in the anterior middle Part of a carious *Tibia*, whoſe Pulſation he ſaw evidently for many Days; and *Mery* (*b*) demonſtrated to the Royal Society at *Paris*, a large Artery piercing croſs a ſound hard Bone.

Veins. Veins no doubt there are, which return the Blood from the Arteries of the Bones, and probably diſcharge themſelves into the Veins of the *Perioſteum.*

Nerves. The great Senſibility of the granulated red Fleſh, that ſprouts out from Bones, after applying a Trepan, or after an Exfoliation; and *Maſſa*'s Obſervation of a painful Ulcer of a Bone already related, make a Probability of Bones being ſupplied with Nerves, tho' we cannot trace them by Diſſection. Nor is this contradictory to what was formerly ſaid, of the Bones being inſenſible in their natural State, if we conſider, that tho' the Nerves do for ordinary communicate Senſibility to all the Parts they ſerve, yet when they are cut, or are too much compreſſed, or when the Part they are ſent to is too rigid to allow Objects to affect them, they produce no ſuch Effect, which laſt, is the preciſe Caſe of Bones as long as they are firm and ſound.

(*a*) Anat. lib. 9. cap. 1.
(*b*) Hiſt de l'Acad. de Sciences, 1704.

ſound. When theſe Circumſtances are rightly weighed, we may, I ſay, be leſs ſurprized at the ſeeming Contradiction of the following Aſſertion, that an unmortified Part of a living Creature can have Nerves diſtributed to it, and yet enjoy no Senſation. Of this we have another Example in Parts very analogous to Bones, the Nails.

Since Bones are plentifully ſupplied with theſe different Sorts of Veſſels, it is plain that there is a conſtant Circulation of Fluids in every Part of them, and that there muſt be a perpetual Waſte and Renewal of the Particles that compoſe the ſolid Fibres of Bones, as well as in the other Parts of the Body; the Addition from the Fluids exceeding the Waſte during the Growth of the Bones, the Renewal and Waſte keeping pretty near *par* in adult middle Age, and the Waſte exceeding the Supply from the Liquors in old Age, as is evident from their Weight. Each Bone becomes heavier as a Perſon approaches to Maturity, continues near the ſame till old Age comes on, and then turns lighter. The ſpecific Gravity of equal Parts of their ſolid Sides obſerving the reverſe Rule, that is, by Age the ſolid Parts of Bones become more hard, compact and denſe.

Diſeaſes. From the intimate Diſtribution of the Veſſels thro' the Subſtance of the Bones, we can judge how theſe Parts may be affected with *Obſtructions*, *Ecchymoſes*, *Ulcers*, &c. from an internal or external Cauſe, as well as the ſofter Parts of the Body; and how the Eroſion of the bony Subſtance by theſe Diſeaſes might occaſion ſuch a cellular

Appearance, as *Ruyſch (a)* deſcribes, in the moſt ſolid Part of a Bone, without giving us any Reaſon to expect ſuch natural *Cancelli* in ſound Bones; or how when the Sides of theſe morbid Cells are deſtroyed, the exterior Part of the Bone may be found as a Tube, including the interior Bone, which *Ruyſch (b)* alſo obſerved. The Reaſon of a common tho' unheaded Phænomenon of carious Bones, to wit, a regular alternate Elevation and ſubſiding, or an apparent Pulſation of the *Pus* contained in ſome of the eroded Cells of the Bone, may likewiſe be hence underſtood.

Chemical Analyſis.

The Bones, in the ſame Manner as the other Parts of Animals, when expoſed to a ſtrong Fire in proper Chemical Veſſels, are reſolved into *Phlegm*, *Spirit*, *volatile Salt*, *fetid Oil*, and a black *Caput mortuum*, which laſt calcin'd in an open Fire, has its more fixed Oil, to which the black Colour was owing, forced away, and a white Earth is left that has no Mixture of fixed Salt in it; on which Account, theſe Aſhes are the moſt proper Materials for forming into Veſſels, that are to undergo the greateſt Force of Fire, being ſcarce capable of ever vitrifying, which other Subſtances are very liable to. This Earth would ſeem to be the proper conſtituent ſolid Part of Bones; for the Quantity of it is great; greater, ſays *Havers (c)*, than of all the other Principles taken together; and after all the others are ſeparated from a Bone, its former Shape ſtill remains, tho'

(*a*) Theſaur. 8. N°. 8. & Theſ. 10. N°. 176.

(*b*) Theſaur. 10. N°. 176.

(*c*) Oſteolog. nov. Diſc. 1.

tho' it becomes ſo brittle as to moulder into Duſt on the leaſt Touch; and when moiſtned with a little Water or Oil, it recovers ſome Degree of Tenacity, but can never be reſtored to its former Firmneſs; ſince it is not poſſible by any Art to reduce Bones to their natural State, once they are changed, and have their ſeveral Principles ſeparated by a chemical *Analyſis.*

Seeing therefore the Solidities of Bones increaſe by Age, and the Proportion of Earth to the other Principles, becomes greater, while ſome of theſe degenerate from their former State, we may ſee one Reaſon why the Bones of old People are more brittle than thoſe of young.

Uſes. The Bones ſerve to ſuſtain, and defend the other ſofter, leſs firm, and leſs ſolid Parts.

PERIOSTEUM INTERNUM. The Bones are lined within, as well as covered externally, with a fine Membrane, which is therefore commonly called *Perioſteum internum.*

This *Perioſteum* is an extremely fine Membrane, nay in ſeveral Bones it has a looſe reticular Texture, and therefore it is compared by ſome to the *Arachnoid* Coat of the ſpinal Marrow; ſo that we cannot expect to divide it into Layers, as we can divide the *external Perioſteum.* We can however obſerve its Proceſſes entering into the tranſverſe Pores of the Bones, where they probably are continued to form the immediate Canals for the Marrow diſtributed through the Subſtance of the Bones.

Probably too *Winſlow (a)* may be right in thinking, that along with theſe Proceſſes of this Membrane, Veſſels are ſent, as from the external *Perioſteum*, into the Bone; but I could never make an Injection enter theſe Veſſels, nor could I ſee them any other Way. Theſe Proceſſes being of a very delicate Texture, the Adheſion of this Membrane to the Bone is ſmall, ſo that it ſeparates commonly more eaſily from the Bone than from the Marrow it contains; wherefore one might call it the common Membrane of the Marrow, rather than the Name it now has. But whether one or t'other Deſignation ought to be given it, is not worthy a Diſpute.

MARROW.

From the internal Surface of the internal *Perioſteum*, a great Number of thin Membranes are produced, which paſſing a-croſs the Cavity, unite with others of the ſame Kind, and form ſo many diſtinct Bags, which communicate with each other; and theſe again are ſubdivided into communicating veſicular Cells, in which the Marrow is contained. Hence it is, that the Marrow, when hardned and viewed with a Microſcope, appears like a Cluſter of ſmall Pearl; and that the hardned Marrow of Bones buried ſeveral Years under Ground, and examined by *Ruyſch (b)*, is granulous, or compoſed of very ſmall Grains, as I have likewiſe frequently ſeen it in Bones laid ſometime in Water, and then expoſed to the Air to dry. This Texture is much the ſame with what obtains in the other cellular

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(*a*) Expoſition anat. des Os frais, § 82. 83.
(*b*) Theſaur, 9, N°, 2, & Adverſ, Dec, III, Obſ, 9.

cellural Parts of the Body, where Fat is collected, only that the Cells containing the Marrow are ſmaller than thoſe of the *Tunica adipoſa* or *celluloſa* elſewhere. The Marrow is nothing then but the more oily Part of the Blood, ſeparate by ſmall Arteries and depoſited into theſe Cells: Any red Colour it ſeems to have in ſome Parts, is owing to the Blood-veſſels on the cells containing it being larger and more numerous at theſe Places.

Arteries. Beſides the Arteries which I mentioned already, *p.* 15, to be ſent from the Bones to the Marrow, there is at leaſt one Artery for each Bone, ſeveral Bones have more, whoſe principal Uſe is to convey and ſecern this oily Matter. After theſe Arteries have pierced the ſolid Side of a Bone, they are divided into ſeveral Branches, which ſoon are diſtributed every where on the internal *Perioſteum*, and afterwards ſpread their Branches on the medullary Cells.

Veins. The Blood, which remains after the Secretion of the Marrow, is returned by proper Veins, which are collected from the Membranes into one or two large Trunks, to paſs out at the ſame ſlanting oblique Hole or Paſſages at which the Artery or Arteries entered.

Nerves. We can trace the Nerves a good Way in their Diviſion on the Membrane of the Marrow along with the Blood Veſſels, but their minute Ramifications proper to the particular Cells are too ſmall for us to diſſect. By the Experiments however of *Du Verney* (a) on Men and Brutes, which I have likewiſe made, the Senſibility of theſe Membranes, and conſequently their being ſupplied with nervous Filaments is ſufficiently proved; the racking Pain with which Suppurations within Bones are frequently attended, gives a woful Conviction how ſenſible theſe Membranes are; ſo that *Hippocrates (a)* might ſay very reaſonably and juſtly, that a Wound penetrating into the Cavity of a Bone would produce a *Delirium*.

(a) Memoires de l' Acad. des Sciences, 1700.

Paſſage. The Arteries, Veins, and Nerves of the Marrow, wrapt up in one common Coat, from the *Perioſteum*, paſs thro' the Bones by proper Channels, the moſt conſiderable of which are about the Middle of each Bone, and are, eſpecially in the human Body, very oblique: Sometimes theſe Veſſels continue at a little Diſtance in their Paſſage, when the bony Canal is divided by a ſmall bony Partition or two.

Uſes. The Marrow is of very conſiderable Uſe to the Bones; for by entring the tranſverſe Pores already deſcribed, and paſſing from them into the longitudinal ones, it is communicated to all the Plates, to ſoften and preſerve them from turning too brittle; and conſequently the Bones are kept ſtronger to reſiſt Injuries. This Diſtribution is thus made more equally, and without weakening the Bones ſo much as a ſufficient Number of tranſverſe Pores alone muſt have done. How far this Oil contributes to the Firmneſs of the Bones, is ſufficiently demonſtrated by obſerving their Brittleneſs, when it is conſumed, or loſes its oily Conſiſtence, as in ſcorbutick, pocky Patients, in old People, or in ſuch Bones as have been deprived of this Oil by Fire or Weather.

(a) Aphoriſm. ſect. 7. Aph. 24.

Beſides this Advantage which the Subſtance of the Bones has from the Marrow, their Articulations receive no leſs Benefit; for there are ſeveral Holes near the large Joints, which communicate with the medullary Cells, and tranſmit the Oil to the Articulations, as is plain from the Marrow found often congealed in theſe Pores of fatted Beaſts. In this Way then, all the Parts concerned in the Motion of the Joint will be lubricated; and when the Mucilage ſecreted here, and to be afterwards deſcribed, is incorporated with the Oil, one of the moſt effectual Mixtures is formed for ſuch an Uſe. The Quantity of this Liquor ſupplied to the Articulations, is always in Proportion to the Quantity of Motion performed by the Joints; and hence by Exerciſe or Labour, the Quantity of Marrow is diminiſhed; ſo that Butchers can tell, by looking at the Bones of ſlaughter'd Cows, whether they have lately come off a Journey, or have been fed ſome Time in Parks in the Neighbourhood.

When the Marrow, after having ſerved the Uſes mentioned, is reaſſumed into the Maſs of Blood, (as it is continually, in common with all the other ſecreted Liquors that have not Paſſages formed for conveying them out of the Body,) it corrects the too great Acrimony communicated to the Saline Particles of our Fluids, by their Circulation and Heat; in the ſame Manner as the Lixivial Salts are blunted by Oil in making Soap. Hence in acute Diſeaſes,

eaſes, the Marrow, as well as the other Fat of the Body, is quickly waſted.

Diſeaſes. As the Nature of all Oil is to become thin and rancid when expoſed long to Heat, we may thence, and from the Structure of the Bones, ſee the Neceſſity of that ungrateful Smell and black thin *Ichor*, which proceeds from corrupted Bones, rather than from any other Part of the Body; and can underſtand the Reaſon of the Changes of Colour which Bones undergo, according to their different Degrees of Mortification. Hence likewiſe we may learn the Cauſe of a *Spina ventoſa*, and of the Difficulty of curing ſuch *Caries* of Bones as proceed from an Obſtruction, and conſequent Putrefaction of the Marrow; and of a quick Pulſe, Thirſt and *hectic Paroxyſms*, ſo often attending theſe Diſeaſes in the Bones. And from theſe *Phænomena* we may deduce the Reaſon of the mortal *Prognoſis* taken from black fetid Urine in Fevers.

Bones diſtinguiſhed. Tho' the Bones ſo far agree in their Structure and annexed Parts, yet we may obſerve a conſiderable Difference among them in their Magnitude, Figure, Situation, Subſtance, Connexion, Uſes, &c. From which Authors have taken Occaſion to diſtinguiſh them into as many Claſſes as they could enumerate of theſe different Circumſtances. But theſe being ſo obvious to every Perſon that looks on Bones, I ſhall content my ſelf with mentioning only one of them; which tho' at firſt Sight very remarkable, yet comprehends very near the whole Bones of the Body, and at the ſame

Time leads us to examine the moſt conſiderable Variety that is to be found in the Diſpoſition of their conſtituent Parts, and in their Uſes. It is this, That ſome Bones are broad and flat, while others are long and round.

Broad. The *broad* Bones have thin Sides, by the Plates being ſoon and equally ſent off to form the *Cancelli*; and this Lattice-work is thicker, and near of an equal Form all through. By this Structure they are well adapted to their Uſes, of affording a large enough Surface for the Muſcles to riſe from, and move upon, and of defending ſufficiently the Parts they incloſe.

Round. The *round* Bones have thick ſtrong Walls in the Middle, and become very thin towards their Extremities; which is owing to very few Plates ſeparating at their Middle, where on that account the *Cancelli* are ſo fine and ſmall that they are not taken notice of: But ſuch Bones are ſaid to have a large Reſervoire of Oil in this Place. Towards their Extremities the Lattice-work becomes very thick, and rather more complete than in the other Sort of Bones. Theſe round Bones having ſtrong Forces naturally applied to them, and being otherwiſe expoſed to violent Injuries, have need of a cylindrical Figure to reſiſt external Preſſure, and of a conſiderable Quantity of Oil to preſerve them from becoming too brittle. Beſides which they are advantageouſly provided with thick Sides towards their Middle, where the greateſt Forces are applied to injure them; while their Hollowneſs increaſes their Diameter, and conſequently their Strength to reſiſt Forces ap-

applied to break them tranſverſely, as has been demonſtrated by *Galilæus (a)*. Thus, for Inſtance, in eſtimating the proportional Reſiſtence of two cylindrical Bones of unequal Diameters, but conſiſting of an equal Number of ſimilar Fibres uniformly diſpoſed round each, it is plain:

1. That the abſolute Force of theſe two Bones is equal, becauſe they conſiſt of equal Number of ſimilar Fibres.

2. That the abſolute Forces of all the Fibres in each Bone will have the ſame Effect, in reſiſting any Power applied to break them, as if the Sum of all their Forces was united in the reſpective Centers of the tranſverſe Sections where the Fractures are to be made. For by Hypotheſis the Fibres being uniformly diſpoſed in each, there is not any Fibre in either Bone that has not a correſponding Fibre, the Sum of both whoſe Diſtances from the Axis of Revolution (about which all the Parts of the Bone muſt revolve in breaking) is equal to two Semidiameters of the Bone: Conſequently each Fibre, and all the Fibres, may be regarded as reſiſting at the Diſtance of one Semidiameter or *Radius* from this Axis, that is, in the Center.

3. Since the united Force of all the Fibres is to be regarded as reſiſting at a Diſtance from the Center of Motion equal to the Semidiameter, it follows that the total Reſiſtance of all theſe Fibres, or the Strength of the Bone will be proportional to its Semidiameter, and conſequently to its Diameter.

(a) Mechanic. Dialog. 2.

I have here taken for an Example one of the moſt ſimple Caſes for calculating the proportional Force of Bones; but was it not too foreign to the preſent Deſign, it might be univerſally demonſtrated, that of whatever Figure Bones are, and in whatever Manner their Fibres are diſpoſed, their Strength muſt always be in a *Ratio*, compounded of the Area of their tranſverſe Sections, or of their Quantity of bony Matter, and of the Diſtance of the Center of Gravity of theſe Sections from the Center of Motion, or Fulcrum, on which the Bone is ſuppoſed to be broken *.

Since therefore the Strength of Bones depends on their Number of Fibres or Quantity of Matter, and the Largeneſs of their Diameters, one may conclude, that the Part of a Bone formerly fractured, and reunited by a *Callus*, muſt be ſtronger than it was before the Fracture happened; becauſe both theſe Advantages are obtained by a *Callus:* Which is a wiſe Proviſion, ſince Bones are never ſet in ſuch a good Direction as they were naturally of; and then wherever a *Callus* is formed, there is ſuch an Obſtruction of the Veſſels, that if the Bone was again broke in the ſame Place, the *oſſifick* Matter could not ſo eaſily be conveyed to reunite it. This *Callus* may indeed, for want of Compreſſion, be allowed to form into a ſpungy cellular Subſtance, as *Ruyſch (a)* ſays he has ſometimes ſeen it; but even in this Caſe the Strength of the Bone at this Part would be ſtill increaſed by one or both the Cauſes above mentioned.

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* See the Demonſtration of this Theorem by Dr. *Porterfield* in the *Edinburgh Medical Eſſays*, Vol. 1. Art. 10.

(a) Theſaur. 8. n. 49. & Muſ. Anat. Thec. B. Repoſit. 2. n. 2.

Many Bones have Protuberances or *Proceſſes* * riſing out from them. If *Proceſſes.* a *Proceſs* ſtands out in a roundiſh Ball, 'tis called *Caput* or *Head*. If the Head is flatned, it obtains the Appellation of *Condyle*. A rough unequal Protuberance is called *Tuberoſity*. When a *Proceſs* riſes narrow, and then becomes large, the narrow or ſmall Part is called *Cervix* or *Neck*. Such *Proceſſes* as terminate in a ſharp Point, have the general Name of *Coronæ* † or *coronoid* beſtowed on them, tho' for the moſt Part they receive particular Names from the Reſemblance they have, or were imagined to have to other Subſtances, *e. g. Maſtoid*, *Styloid*, *Anchoroid*, *Coracoid*, *Spinal*, *&c.* Such Proceſſes as form Brims of Cavities are called *Supercilia* *.

Proceſſes ſerve for the advantageous Origine and Inſertion of Muſcles, and *Uſes.* render the Articulations firmer and more ſtable.

Before leaving this Subject we muſt remark, that much the greater Number of what are called Proceſſes in adult Bones, diſcover themſelves in Children to be *Epiphyſes* or diſtinct Bones, to be affixed afterwards; as the *Maſtoid* and *Styloid* Proceſſes of the temporal Bones, Proceſſes of the *Vertebræ*, *Trochanters* of the Thigh, *&c.* However, as I deſign to inſiſt chiefly

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* Ἀπόφυσεις, ἔκφυσεις, ἐξοχὴ, προβολὴ, πρόβλημα, Exceſſus, Explantatio, Tuberculum, Gibbus, Eminentia, Productio, Extuberantia, Projectura, Enaſcentia.

† Roſtra, Glandes.

* Ἴτυες, ὄφρυες, ἄμβονες, χείλη, Labra.

chiefly on the Deſcription of the adult Skeleton, in which the Union of theſe Parts is ſo very intimate that ſcarce any Veſtige remains of their former Separation, I ſhall retain the common Appellation of *Apophyſe* or Proceſs to all ſuch Protuberances; but ſhall remark the principal ones that have no juſt Title to this Name, when they occur in the Deſcription of particular Bones.

Cavities. In a great many of the Bones there are Cavities: If theſe are deep, with large Brims, Authors name them *Cotylæ* †; if they are ſuperficial, they obtain the Deſignation of *Glenæ* or *Glenoid*. Which general *Claſſes* are again divided into particular *Species*: Of which *Pits* are ſmall roundiſh Channels ſunk perpendicularly into the Bone; *Furrows* are long narrow Canals formed in the Surface; *Niches* or *Notches*, ſmall Breaches in the Bone; *Sinuoſities*, broad but ſuperficial Depreſſions without Brims; *Foſſæ*, large deep Cavities which are not equally ſurrounded by high Brims; *Sinuſes*, large Cavities within the Subſtance of the Bones, with ſmall Apertures; *Foramina* or Holes, Canals that pierce quite thro' the Subſtance of the Bones. When this laſt Sort of Cavity is extended any large Way within a Bone, the middle Part retains the Name of *Canal*, and its Extremities are called *Holes*.

Uſes. The Uſes of the Cavities are very numerous; ſuch as, to allow Heads of Bones to play in, to lodge and defend other ſofter Parts, to afford a ſafe Paſſage for

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† Κοτυλίδες, ὀξυβάφοι, Acetabula, Pixides, Buccellæ.

Veſſels, Muſcles, *&c.* To mention more would engage us too much in the Hiſtory of particular Bones, which more properly belongs to the Demonſtration of the *Skeleton*, where we ſhall have occaſion to obſerve theſe ſeveral Species of Cavities.

Epiphyſes.

To far the greater Number of Bones, whoſe Extremities are not joined to other Bones by an immoveable Articulation, there are ſmaller ones annexed, which afterwards become ſcarce diſtinguiſhable from the Subſtance of the Bone itſelf. Theſe are called *Epiphyſes* or *Appendices* *. Some Bones have one, others have two, three or four of theſe *Appendices* annexed, by the means of Cartilages which are of a conſiderable Thickneſs in Children, but by Age become thinner, the Oſſification proceeding from the Extremity of the Bone on one Side, and from the *Epiphyſes* on the other, till at laſt, in Adults, the Place of their Conjunction can ſcarce be obſerved on the external Surface: And, as *Winſlow (a)* obſerves, it is only ſometimes that we can then ſee any Mark of Diſtinction in the *Cancelli.*

Uſes.

The *Epiphyſes* are united chiefly to ſuch Bones as are deſtin'd for frequent and violent Motion; and for this Purpoſe they are wiſely framed of a larger Diameter than the Bone they belong to; for by this means the Surface of Contact between the two Bones of any Articulation being increaſed,

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* Applantatio, Additamentum, Adnaſcentia, Adnexum, Perone.

(a) Expoſition Anatomique de Corps Humain Traitè des Os ſecs, § 116.

creaſed, their Conjunction becomes firmer, and the Muſcles inſerted into them act with greater Force, by reaſon of their Axes being further removed from the Center of Motion. Theſe Advantages might indeed have been obtained by the Expanſion of the Extremity of the Bone itſelf to a Thickneſs equal to that of the *Epiphyſes*; but then the conſtant Separation of new Plates to form ſo wide a cellular Structure, muſt have left the ſolid Sides of the Bones ſo thin, as to yield eaſily, either to the Action of the Muſcles fixed to them and paſſing over them, to the Weight ſeveral of them are obliged to ſupport, or to the Application of any other external Force.

Beſides theſe Uſes, the *Epiphyſes* ſerve other Purpoſes; ſuch as, ſecuring the Ligaments of the Articulations, which riſe out from between the Bones and them; for as ſoon as theſe Parts are intimately conjoined, the Ligaments inſinuated betwixt them muſt have a much ſtronger Connection than they could have to the ſmooth Surface of the Bones, as *Columbus* (a) and *Fallopius* (b) have remarked. And then the *Epiphyſes* hinder the Fibres of the Bone to run out too far, and to join with its neighbouring Bone, which would deprive us of all Motion, while the Fibres of the *Epiphyſes*, which ſeem not ſo much diſpoſed in a ſtreight Direction, are prevented from the like Inconvenience, by the Interpoſition of Cartilages. That we would be liable to ſuch an Inconvenience without this Mechaniſm, is evident from the Obſervations of the bony Proceſſes, which jet out preternaturally from Bones when the *Perioſteum* is deſtroyed, and they are not reſtrained in their Growth; and from the Lameneſs which happens ſo frequently after the Eroſion of the Cartilages, when the Fibres of two Bones deſign'd for Motion run one into another, which is the worſt Species of *Anchyloſis*, as every Day happens in Wounds of the Joints, and Ulcers from the *Paidarthrocace*, *Scrophula* and *Spina ventoſa*. The ſame Diſeaſe likewiſe frequently follows the Oſſification of theſe Griſtles from old Age or any other Cauſe. Two very remarkable Inſtances of an univerſal *Anchyloſis* are related by *Columbus (a)* and *Deſlandes (b):* The firſt Author ſays, he ſaw a Skeleton whoſe Bones from the Head to the laſt Joints of the Toes were all immoveably united; and the other gives the Hiſtory of a Child near two Years old, that had not a moveable Joint.

(a) De re Anatomica, lib. 1. cap. 2.
(b) Expoſit. de oſſibus, cap. 11.

We may here obſerve, with *Veſalius* (*c*), that ſeveral Proceſſes, as the *Trochanters* of the Thigh and Spine of the *Scapula*, have *Epiphyſes*; and that from the *Epiphyſes* frequently Proceſſes riſe out, as at the lower Extremity of the *Femur*, *Ulna*, *Tibia*, &c.

OSSIFICATION.

It may perhaps ſeem improbable, that ſuch hard Bodies as the Bones ſhould be ſo luxuriant and ſprouting. But this will not appear ſo ſurpriſing when it is demonſtrated, that however ſolid and compact adult Bones are, yet they were once

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(*a*) De re Anatomica, lib. 15.
(*b*) Hiſtoire de l'Acad. des Sciences 1716.
(*c*) De humani corporis fabrica, lib 1. cap. 3.

once Cartilages, Membranes, nay a mere Gelly. This needs no further Proof, than repeated Obſervations of *Embryos* when diſſected: And how much more tender muſt the Bones be before that Time, when neither Knife nor Eye is capable to diſcover the leaſt Rudiments of them? By degrees they become more ſolid, then aſſume the Nature of Griſtles, and at laſt oſſify: Which is brought about, partly by the Bones being more than any other Parts expoſed to the ſtrong Preſſure of the great Weights they ſupport, to the violent Contraction of the Muſcles fixed to them, and to the Force of the Parts they contain, which endeavour to make Way for their own further Growth. By all this preſſing Force the ſolid Fibres and Veſſels of the Bones are thruſt cloſer, and ſuch Particles of the Fluids conveyed in theſe Veſſels as are fit to be united to the Fibres, are ſooner and more firmly incorporated with them, while the remaining Fluids are forcibly driven out by the Veins to be mixed with the Maſs of Blood. In conſequence of which we obſerve, that gradually, as the Bones harden, the proportional Number and Largeneſs of their Veſſels decreaſe. From which again we can underſtand one Reaſon of the Bones of young Creatures ſooner reuniting after a Fracture, than thoſe of old. From this alſo we can deduce the Cauſe of Horſes, Bullocks, and other young Creatures of a large Brood, decaying in their Size, when put too ſoon to hard Labour.

That the oſſifying of Bones does depend much on ſuch a Preſſure, ſeems to be evinced from the frequent Examples we meet with of other Parts turning bony, when long expoſed to the compreſſing Force of the ſurrounding Parts, or when they are ſubjected to the like Circumſtances by their own frequent and violent Contraction. Witneſs the Bones found ſo frequently near the Baſe of the Heart in ſome old Men, and in ſeveral other Creatures. Nay the muſcular Subſtance of the Heart has been oſſified in ſuch, Inſtances of which *Cheſelden (a)* and *Garengeot (b)* give us; and the Arteries of old Men often become bony. The Cartilages of the *Larynx* are generally oſſified in Adults. In Beaſts of Burden the Cartilages between the *Vertebræ* of the Back and Loyns very often change into complete Bones, and being intimately united with the *Vertebræ*, the whole appears one continued Bone. Nor is the *Perioſteum* exempted from ſuch an Induration; for *Peyer (c)* tells us, he divided this Membrane into ſeveral bony Plates.

To confirm this Argument ſtill further, we may obſerve, that Bones begin their Oſſification at the Places where they are moſt expoſed to theſe Cauſes, *viz.* in the cylindrical Bones from a middle Ring, and in the broad ones at or near their Center, from one or more diſtinct Points. The Reaſon of which is, that theſe Parts are contiguous to the Bellies of the Muſcles annexed to the Bones, where the ſwelling of theſe moving Powers is greateſt. What the Effects of this may be, let any judge who view ſome of the Bones, as the *Scapula* and *Iliûm*,

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(*a*) Anatomy, Book 1. Chap 1.

(*b*) Hiſtoire de l'Acad. des Sciences 1726.

(*c*) Ephemerid. German. Decur. 2. Ann. 7. Obſerv. 205.

Iliûm, which are on each Side covered with Muſcles; how compact and thin they are in Adults, where the Bellies of the Muſcles were lodged, whereas in Children they are thicker. But this being the middle Part of theſe Bones where the greateſt Number of Fibres is, this particular Place would have been much thicker in Adults, had not this forcible Cauſe been applied, which has not had ſuch Effects in Children whoſe Muſcles have not been much exerciſed. Beſides, if we allow that all the Parts of a Bone are equally increaſed by the conſtant Supply of new Particles, each Fibre and every Particle of a Fibre will endeavour to make way for its own Growth, by puſhing the one next to it; and conſequently by far the greateſt Preſſure will be on the Middle: Wherefore the Particles there will be made moſt firm: And here it is that Bones begin their Oſſification. Laſtly, The Pulſation of the medullary Arteries, which enter the Bones near to this middle Part, may, as Authors have alledged, contribute perhaps ſomewhat to this Induration.

From the Effects of Preſſure only it is, that we can account for the Bones of old People having their Sides ſo much thinner, yet more denſe and ſolid, while the Cavities are ſo much larger than in young Bones; and for the Prints of Muſcles, Veſſels, *&c.* being ſo much ſtronger marked on the Surfaces of Bones according to their Ages, if they belong to People of near the ſame Condition of Life, or if they belong to thoſe of the ſame Age, according to the Labour or Exerciſe they have had. The Bones of old People and of thoſe accuſtomed to Labour being more ſtrongly impreſſed than thoſe of young Folks, and of ſuch who have lived in Indolence and Inactivity.

It is alſo probable, that Oſſification depends on the Veſſels of the Bones being ſo diſpoſed, and of ſuch Diameters, as to ſeparate a Liquor, which may eaſily, when deprived of its thinner Parts, turn into a bony Subſtance; as ſeems plain from the Obſervation of the callous Matter ſeparated after Fractures and Ulcers, where Part of the Bone is taken out: For in theſe Caſes this Liquor hardens, and often cements the two Extremities of a Bone, tho' at a good Diſtance from each other; as I have ſeen happen in two or three Caſes, and of which there are abundance of very remarkable Inſtances handed down by Authors. One, ſcarce inferior to any of them, was communicated to me by Mr. *Laing* Surgeon at *Jedburgh*, and is now publiſhed *(a)*, of a Child, whoſe *Tibia* he took out, leaving little more than the *Epiphyſes* at each Extremity; all that he took away of the Bone was ſupplied by a bony Subſtance, on which his Patient walks eaſily and firmly.

Perhaps both the Cauſes of Oſſification above mentioned may be aſſiſted by the Nature of the Climate People live in, and the Food they uſe. Whence in hot Countries the Inhabitants ſooner come to their Height of Stature, than in the Northerly cold Regions: And thence ſeems to have ariſen the common Practice among the Ladies of making Puppies drink Brandy or Spirit of Wine, and of bathing

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(a) Medical Eſſays and Obſervations publiſhed at *Edinburgh*, Vol. I. Art. 23.

ing them in theſe Liquors, to prevent their growing big. Nay it has been obſerved, that much Uſe of ſuch Spirits has occaſioned Parts naturally ſoft to petrify in ſome, and to oſſify in other People of no great Age. Witneſs the Caſes related by *Littre (a)* and *Geoffroy (b)*.

Diſeaſes.

From the foregoing Account of the Structure of Bones, and of their Oſſification, we may underſtand the Reaſons of the following Phænomena.

How the natural Colour of the Bones may be changed by ſome Sorts of Food, as has been obſerved by Mr. *Belchier (c)*.

Why the Bones of ſome People are ſo long of hardning, and in others never completely indurate.

Why in ſuch whoſe Oſſification is very ſlow, the Bones are generally thicker in proportion to their Lengths, eſpecially at their Extremities, as in the *Rickets*.

How by Diſeaſes hard firm Bones have become ſoft and pliable, as is related by *Courtial (d)*, *Gagliardi (e)*, *Petit (f)*, and a great many Authors, from whom a conſiderable Collection may be read in the *Ephemerides Germanicæ (g)*.

How in ſome Caſes the Bones may waſte and diminiſh, an Inſtance of which we have from

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(*a*) Hiſtoire de l'Acad. des Sciences 1706.

(*b*) Memoires de l'Acad. des Sciences 1706.

(*c*) Philoſoph. Tranſact. N°. 442. Art. 8. and N°. 443. Art. 2.

(*d*) Hiſtoire de l'Acad. des Sciences 1700.

(*e*) Anatom. oſſium. cap. 2. obſerv. 3.

(*f*) Memoires de l'Acad. des Sciences 1722.

(*g*) Decur. 1. ann. 1. obſ. 37. & ſchol. Decur. 2. ann. 7. obſ. 212, 235. Decur. 3. ann. 2. obſ. 3.

from *Cheſelden (a)*, and in that Caſe of *Courtial* juſt now mentioned.

How the Bones may become ſolid all through, without any Appearance of *Cancelli*, as *Ruyſch (b)* has obſerved.

Why the *Epiphyſes* ſeparate from the Bones in ſome Diſeaſes *(c)*.

How *Nodes*, *Tophi* and *Exoſtoſes* happen after the Eroſion of the external Plates of the Bones in the *Lues Venerea*, *Scurvy*, *Rheumatiſm* and *Gout*.

What occaſions ſuch Difficulty ſometimes in curing fractured Bones, or why they never reunite, tho' they are reduced, and all proper Means towards a Cure are uſed *(d)*.

Why the Effects of eroding acrid Matter on Bones may be very different, and conſequently why there may be ſeveral more ſpecies of carious Bones than are commonly deſcribed.

How ſeveral Liquors may ſerve to ſoften, and even diſſolve their Subſtance.

Oſteogenea. Whoever is deſirous to know, in what Time and Order each Bone and its ſeveral Parts begin to aſſume a bony Nature, let him conſult *Kerckringius (e)*, who gives us the Delineations of Abortions from three Days after Conception, and traces the Oſſification of the Bones from three Weeks and a Month, till the Time of the

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(a) Anatomy, Book 1. Chap. 1.

(b) Theſaur. 2. Arc. 5. Theſ. 3. Loc. 1. N°. 5, Theſ. 9. N°. 2. not. 3.

(c) Memoires de l'Acad. des Sciences 1699.

(d) Meck'ren. Obſerv. Medico-chirurg. Obſ. 71. Ruyſch Adverſ. Dec. 2. § 2. Obſerv. Anat. Chir. Obſ. 4.

(e) Anthropograph. Ichnograph. & Oſteogenea Fœtuum

Birth: To whom ſhould be added *Coiteru* *(a)* and *Eyſſonius (b)*. A pretty complete Account of this Subject might alſo be collected out of *Ruyſch*'s Works, where ſome of the Miſtakes committed by the former Authors are corrected, and ſeveral more Particulars to make the Account of the *Oſteogenea* more accurate, have ſince been added by *Nesbitt (c)* and *Albinus (d)*.

I muſt refer to the Authors now quoted fo the more curious Part of the human Oſteogeny, not having Preparations enough to giv ſuch a full Hiſtory of it as is done by them but I ſhall endeavour to explain the more uſeful and neceſſary Part of this Oſteogeny, b ſubjoining to the Deſcription of each particular Bone of an Adult, its particular State i ripe Children, that is, in ſuch as are born a the ordinary Time, and ſhall point out wha Parts of each are afterwards joined in Form o *Epiphyſes*. This, with the following genera Rules, ſeems to me ſufficient for underſtanding what of this Subject is neceſſary in the Practice of Phyſick and Surgery.

1. Wherever I mention any Parts being cartilaginous, or their being ſtill ſeparable from the other Parts of their proper Bone, I woul be underſtood to hint, that about ſeven o eight Years of Age, ſuch Parts are oſſified an united to their proper Bones, unleſs when it ſaid, that they are afterwards formed into *Epiphyſes*.

2. Succ

(a) De oſſibus fœtûs abortivi.

(b) De Oſſibus Infant. cognoſcend. & curand.

(c) Human Oſteogeny explained.

(d) Icones oſſium fœtûs humani accedit oſteogen brevis hiſtoria.

2. Such as become *Epiphyſes*, are generally oſſified at ſeven or eight Years old, but being for the moſt Part moiſtned by *Synovia*, their external Surface is ſtill ſomewhat cartilaginous, and they are not yet united to their Bones.

3. At eighteen or twenty Years of Age, the *Epiphyſes* are entirely oſſified, and have blended their Fibres ſo with the Body of the Bone, as to make them inſeparable without Violence.

4. The Ridges, Depreſſions, and other Inequalities of Bones being principally owing to the Actions of Muſcles fixed to them, and ſituated near them, it will follow, that whereever Muſcles have acted leaſt, there the Bones will have feweſt Inequalities; and therefore that we are to expect theſe Inequalities to increaſe according to People's Ages.

The Knowledge of this Part of the *Oſteogeny*, which I have undertaken thus to explain, I think neceſſary to prevent dangerous Miſtakes in the Cure of ſeveral Diſeaſes: As for Example, without this Knowledge, the Separation of an *Epiphyſe* might be miſtaken for a Fracture or Luxation; the Interſtice of two Parts of a Bone not yet conjoined might be judged to be a Fiſſure; a *Diaſtaſis*, or other violent Separation of ſuch disjoined Pieces of a Bone, might be thought a great Fracture; and the Protruſion of one Piece, or its overloping any other, could be miſtaken for an Excreſcence or *Exoſtoſis*. Such Errors about the Nature of a Diſeaſe would give one very different Indications of Cure, from what he would have, if he really underſtood his Patient's Caſe. And very often the Knowledge of the different Inequalities on the Surfaces of Bones, muſt direct us in the Execution of what is proper to be done to cure ſeveral Diſeaſes of Bones.

ARTICULATIONS.

Having thus conſidered the Bones as ſingle, we ought next to ſhew the different Manner of their Conjunctions[*]. To expreſs theſe, Anatomiſts have contrived a great Number of technical Terms, about the Meaning, Propriety and Claſſing of which there has unluckily been great Variety of Opinions. Some of them it is neceſſary to retain, ſince they ſerve to expreſs the various Circumſtances of the Articulations.

The Articulations are moſt commonly divided into three Claſſes, the *Symphyſis*, *Synarthroſis*, and *Diarthroſis*.

Symphyſis.

The *Symphyſis*, which properly ſignifies the Concretion or growing together of Parts; when uſed to expreſs the Articulations of Bones, does not ſeem to comprehend under the Meaning generally given to it, any thing relating to the Form or Motion of the conjoined Bones, but by it Authors only denote the Bones to be connected by ſome other Subſtance; and as there are different Subſtances which ſerve this Purpoſe, therefore they divide it into the three following Species,

Synchondroſis.

1. *Synchondroſis* [†], when a Cartilage is the connecting Subſtance; thus the Ribs are joined to the *Sternum*; thus the Bodies of the *Vertebræ* are connected

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[*] *Σύνταξις, σύνθετις, συμβολὴ, ὁμιλία*, Compoſitio, Connexio, Articulatio, Conjunctio, Nodus, Commiſſura, Structura, Compages.

[†] Amphiarthroſis.

ſted to each other, as are likewiſe the *Oſſa Pubis.*

Synneuroſis.

2. *Synneuroſis*, or *Syndeſmoſis*, when Ligaments are the connecting Bodies, as they are in all the moveable Articulations.

Syſſarcoſis.

3. *Syſſarcoſis*, when Muſcles are ſtretched from one Bone to another, as they muſt be where there are moveable Joints, and frequently too where Bones are not moveable.

Synarthroſis.

The ſecond Claſs of Articulations the *Synarthroſis*, which is ſaid to be the general Term by which the immoveable Conjunction of Bones is expreſſed, is divided into two Kinds.

Suture.

1. The *Suture* † is that Articulation where two Bones are mutually indented into each other, or as if they were ſowed together, and is formed by the Fibres of two Bones meeting while they are yet flexible and yielding, and have not come to their full Extent of Growth, ſo that they mutually force into the Interſtices of each other, till meeting with ſuch Reſiſtance as they are not able to overcome, they are ſtopped from ſprouting out farther or are reflected; and therefore, theſe Indentations are very different both in Figure and Magnitude. Thus the Bones of the Head are conjoined; thus likewiſe the *Epiphyſes* come before the full Connection to be joined with the Bones. Under this Title of *Suture*, the *Harmonia* of the Antients may be comprehended, ſince,

Harmonia.

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† Ῥαφή.

as *Veſalius (a)* has well remarked, ſcarce any unmoved Bones are joined by plain Surfaces.

Gomphoſis. 2. *Gomphoſis* * is the fixing one Bone into another, in the ſame Manner as a Nail is fixed in a Board; thus the Teeth are ſecured in their Sockets.

To theſe may be added *Keil*'s *(b) Schindyleſis* or *Ploughing*, when a thin *Lamella* of one Bone is received into a long narrow Furrow of another; thus the *Proceſſus azygos* of the *ſphenoid* Bone, and the naſal Proceſs of the *ethmoid* Bone, are received by the *Vomer*.

Diarthroſis. The *third* Claſs or *Diarthroſis* † is the Articulation where the Bones are ſo looſely connected as to allow a large Motion. This again is ſubdivided into three Sorts.

Enarthroſis. The firſt of theſe Kinds of *Diarthroſis* is *Enarthroſis*, or the Ball and Socket, when a large Head is received into a deep Cavity, as the Head of the *Os Femoris* is into the *Acetabulum Coxendicis*.

Arthrodia. The next Species is *Arthrodia*, when a round Head is received into a ſuperficial Cavity, as in the Articulation of the Arm-bone and *Scapula:* Both this and the former Sort of Articulation allow Motion to all Sides.

Ginglimus. The laſt Sort is *Ginglimus* ‡, which properly ſignifies the Hinge of a Door or Window; in it, the Parts

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(*a*) Obſerv. Fallop. examen.

* Conclavatio.

(*b*) Anat. Chap. 5. Sect. 3.

† Ἀπαρθρώσις, Dearticulatio, Abarticulatio.

‡ Articulatio mutua.

Parts of the Bones mutually receive and are received, and allow of Motion two Ways; Tradeſmen call it *Charnal*. The *Ginglimus* is generally divided into theſe three Kinds, to which *Baker* (a) gives the Names of *proximus*, *longus* and *compoſitus*. The firſt is when a Bone has ſeveral Protuberances and Cavities, which anſwer to as many Cavities and Proceſſes of the other Bone with which it is articulated, as in the Conjunction of the *Femur* with the *Tibia*.

The *Second* Species is, when a Bone receives another at one End, and is received by the ſame Bone at the other Extremity, as in the Articulations of the *Radius* and *Ulna*.

The *Laſt* Sort is, when a Bone receives another, and is received by a third, as in the oblique Proceſſes of the *Vertebræ*.

When I firſt mentioned the Articulations of Bones, I ſaid there were different Opinions concerning the Uſe of theſe technical Words applied to the Conjunctions of Bones, *e.g.* It has been ſaid, that *Symphyſis* ſhould be the Name for the immoveable Articulations, and that by *Synarthroſis* ſhould be underſtood the Conjunction of Bones by ſome connecting *medium*.--- Thoſe who have taken *Symphyſis* in the Senſe I did, of its expreſſing the Conjunction of Bones with a connecting Subſtance, have diſagreed in their Definition of it, ſome inſerting, and others leaving out its allowing Motion.—— Where they have agreed in their Definition, they have not been of the ſame Mind concerning the Species of it. For ſeveral think the *Syſar-*

(a) Curſ. oſteolog. Demonſtr. 1.

Syſarcoſis and *Syndeſmoſis* applicable to ſo many Joints which are univerſally allowed to be claſſed under the *Diarthroſis*, that it muſt create Confuſion to name them by any Species of the *Symphyſis*.—— Few keep to ſuch a general Definition of the *Synchondroſis* as I have done, and whether they determine it to allow no Motion, or an obſcure or a manifeſt one, bring themſelves into Difficulties, becauſe there are Examples of all theſe three Kinds.--- Some again, by too nicely diſtinguiſhing obſcure and manifeſt Motions of Bones, have blended the *Synarthroſis* and *Diarthroſis*, and from thence have branched out the different compound Species of Articulations that may be formed of them ſo far, that they could find no Examples in the Body to illuſtrate them by. ——It would be tedious to enumerate more of the jarring Opinions, and it would be far more ſo to give a Detail of the Arguments uſed by the Diſputants. It is ſufficient for my Purpoſe, that it is underſtood what Senſe I take theſe technical Terms in, which I do in the following Manner.

When I mention the *Symphyſis* or *Synarthroſis*, or any Species of them, I ſhall always underſtand them according to the Explication I have firſt given of them. But tho' the Account already given of the *Diarthroſis*, or Articulation of moveable Bones, has been almoſt univerſally received as juſt, yet ſeeing it does not comprehend all the moveable Articulations of the Body, and one of its Species does not anſwer to any Notion we can have of the Conjunction of two Bones, I muſt beg leave to change the Definitions and Kinds of theſe Joints.

I

I would call *Diarthroſis* that Conjunction of Bones, whereby they are fitted for Motion, being each covered with a ſmooth Cartilage, connected by one or more common Ligaments, and lubricated with *Synovia* at the conjoined Parts. In which Definition, I have no Regard to the Quantity of Motion which they really do perform; the Motion being often confined or enlarged by ſome other Cauſe not immediately depending on the Frame of the two Surfaces of the Bones, forming the particular Joint, which then is conſidered.

Diarthroſis.

The firſt Species of the *Diarthroſis*, viz. the *Enarthroſis* or Ball and Socket, I would define more generally than above, That Articulation where a round Head of one Bone is received into a Cavity of another, and conſequently without ſome foreign Impediment, is capable of Motion to all Sides: Examples of this Kind are to be ſeen in the Articulation of the Thigh-bone and *Oſſa Innominata*; of the Arm-bone and *Scapula*; *Aſtragalus* and *Os Naviculare*; *Magnum* or *Capitatum* of the Wriſt, with the *Scaphoides* and *Lunare*; firſt Bone of the Thumb, with the ſecond, &c.

Enarthroſis.

The ſecond Sort or *Arthrodia* differing only in the preceeding Account from the *Enarthroſis*, in the Cavity being more ſuperficial, which makes no eſſential Difference, eſpecially ſeeing that in the recent Subject, Cartilages or Ligaments ſupply the Deficiency of Bone, ought in my Opinion to be called with *Veſalius* (*a*), that Ar-

Arthrodia.

(*a*) De corp. human. fabrica, lib. 1. Cap. 4.

Articulation of two Bones adapted for Motion, where it is not at firſt Sight obvious which of the two has the Head or Cavity, or where they are joined by plain Surfaces or nearly ſo, ſuch is the Conjunction of the *Clavicle* with the *Scapula*; *Oſſa Cuneiformia* with the *Os Naviculare*; *Metatarſal* Bones with the *Oſſa Cuneiformia*, &c. From the Nature of this Sort of Joint, it is plain that very great Motion cannot be allowed without the Bones going farther out of their natural Situation, than is convenient or ſafe.

Ginglimus. *Ginglimus* I would reckon that Articulation, by the Form of which, the Motion of the conjoined Bones, muſt be moſtly confined to two Directions, which hinges of Doors are. The first Species of this is the *Trochoides*, when the one Bone turns on the other, as a Wheel does on its Axis; thus the firſt *Vertebra* of the Neck, moves on the Tooth-like Proceſs of the ſecond. This is moſt commonly neglected by late Writers, tho' it is the moſt proper Kind of *Ginglimus*.

Trochoides.

Proximus. The ſecond Species ſhould be eſteemed that Articulation, where, within the ſame common Ligament, ſeveral prominent and hollow Surfaces of two Bones move on each other, as in the Knee, Elbow, *&c.*

Longus. The third Sort of *Ginglimus*, is when two Bones are articulated to each other at different Parts, with a diſtinct *Apparatus* of the motory Machines at each, ſuch is the Articulation of the *Os Occipitis* with the firſt *Vertebra* of the Neck, of any two contiguous *Vertebræ* by their oblique Proceſſes, of the Ribs with the Body and tranſverſe Proceſs of the *Vertebræ*, of the *Radius* with the *Ulna*, *Tibia* with the *Fibula*, *Aſtragalus* with the *Calcaneum*, &c.

What is commonly enumerated as the third Kind of *Ginglimus*, I would entirely throw out; for in conſidering the Conjunction of a Bone with two others, as in the common Example of a *Vertebra* joined with the one above and below, each ought to be obſerved diſtinct; otherwiſe we might with the ſame Property eſteem the Articulations that the long Bones, ſuch as the *Femur*, *Tibia*, *Humerus*, &c. have at their different Extremities, as one Articulation, which readily would be granted to be abſurd.

If the moveable Bones were not connected and kept firm by ſome other ſtrong Subſtance, they would be luxated at every Motion of the Joints; and if the hard rough unequal Surfaces of ſuch Bones were to play on each other, they would not only produce a Difficulty in their Motion, but would occaſion too great Loſs of the bony Subſtance: Therefore the Almighty and infinitely wiſe Author of our Beings has framed *Ligaments* to obviate the firſt, and *Cartilages* to prevent the other Inconveniency; but, becauſe Ligaments and Cartilages would turn rigid, inflexible and rough, unleſs they were kept moiſt, a ſufficient Quantity of proper Liquors is ſupplied for their Lubrication, and to preſerve them in a flexible State. Seeing then theſe Parts are ſo neceſſary to the Articulations, I ſhall next conſider their Structure, Situation and Uſes, as far as they are ſubſervient to the Bones.

LIGAMENTS.

Ligaments * are white flexible Bodies, thicker and firmer than Membranes, and not ſo hard or firm as Cartilages, without any remarkable Cavity in their Subſtance, difficultly ſtretched and with little Elaſticity, ſerving to connect one Part to another, or to prevent the Parts to which they are fixed from being removed out of that Situation which is uſeful and ſafe. I have been the more particular in this Deſcription, attempting to prevent the Hazard of young Anatomiſts having their Minds perplexed and Ideas confounded, in determining to what Claſs ſeveral Subſtances obſervable in the human Body, are to be reduced, whether, to wit, they ought to be called Membranes, Ligaments or Cartilages, which there is often too little Care taken to characterize ſufficiently, and the Examples commonly mentioned do not illuſtrate enough: It muſt however be acknowledged, that ſome Bodies have their Texture and Uſes ſo blended between the Membrane and Ligament, or between this laſt and the Cartilage, as to render their Names very ambiguous; I would hope ſuch a Deſcription as is given above, would in ſome Meaſure prevent this Confuſion.

Layers of Fibres.

After Maceration in Water, the Ligaments can eaſily be divided, and each ligamentous Layer appears compoſed of Fibres, the largeſt of which are diſpoſed in a longitudinal Direction.

The

(*) Σύνδεσμοι, νεῦροι, Copulæ, Vincula.

The Blood Veſſels of the Ligaments are very conſpicuous after a tolerable Injection. Such Ligaments as form the Sides of Cavities, have numerous Orifices of their Arteries opening upon their internal Surface, which are conſtantly throwing out a fine thin Lymph there, as evidently appears upon Preſſure after the Moiſture has been rubbed off with a dry Cloath; and it is reaſonably to be preſumed from what is to be obſerved in other Cavities, that there are correſponding Veins to abſorb Liquors from the Cavities which the Ligaments form. *Veſſels.*

Authors generally ſay, that Ligaments are inſenſible, and conſequently it may be inferred that they have no Nerves beſtowed on them; but the violent racking Pain, felt on the leaſt Motion of a Joint labouring under a *Rheumatiſm*, the Seat of which Diſeaſe ſeems often to be in the Ligaments, and the inſufferable Torture occaſioned by a Collection of acrid Matter in a Joint, or by *Tophi* in the Gout, would perſwade us of their being abundantly ſupplied with Nerves. *Nerves.*

The Ligaments which ſerve to connect the movable Bones, commonly riſe from the Conjunction of the *Epiphyſes* of the one Bone, and are inſerted into the ſame Place of the other; or where *Epiphyſes* are not, they come out from the *Cervix*, and beyond the *Supercilia* of the articulated Bones; and after ſuch a Manner in both Caſes, as to include the Articulation in a Purſe or Bag, with this Difference, depending on their different Motions, that where the Motion is only *Uſes.*

only to be in two Directions, the Ligaments are ſtrongeſt on thoſe Sides towards which the Bones are not moved; and when a great Variety of Motions is deſigned to be allowed, the Ligaments are weaker than in the former Sort of Articulations, and are near of the ſame Strength all round.

Beſides theſe common circular Ligaments of Joints, there are in ſeveral Places particular ones, either for the firmer Conjunction of the articulated Bones, or for reſtraining and confining the Motion to ſome one Side; ſuch are the croſs ones of the Ham, the round Ligament of the Thigh, *&c.*

From this Account of the Ligaments, *Fabricius ab Aquapendente*'s *(a)* Obſervation will appear juſt, that *cæteris paribus*, in whatever Articulation, the Ligaments are few, long and weak, the Motion will be more free and quick, but Luxations will frequently happen; and on the contrary, where the Ligaments are numerous, ſhort and ſtrong, the Motion will be more confined, but ſuch a Joint will be leſs expoſed to Luxations.

Ligaments are alſo of Service to the Bones in ſeveral other Reſpects; as for Inſtance, they ſupply the Place of Bones in ſeveral Caſes to Advantage; thus the Parts in the *Pelvis* are more ſafely ſupported below by Ligaments, than they could have been by Bone. The Ligaments placed in the great Holes of the *Oſſa Innominata*, and between the Bones of the Fore-arm and Leg, afford convenient Origin to Muſcles. Immoveable Bones are more firmly connected by them; of which the Conjunction of the *Os ſacrum* and *Oſſa Innominata* is an Example; and they afford a Socket for moveable Bones to play in, as we ſee Part of the *Aſtragalus* does on the Ligaments ſtretched from the Heel-bone to the *Scaphoid* Bone.

(a) De Articul. Part. utilit. pars tertia.

CARTILAGES.

Cartilages * are ſolid, ſmooth, white elaſtick Subſtances, between the Hardneſs of a Bone and Ligament; and covered with a Membrane named *Perichondrium*, which is a-kin to the *Perioſteum* of the Bones.

Plates and Fibres.

The Cartilages are compoſed of Plates, which again are formed of Fibres diſpoſed much in the ſame Way as Bones have them, as might be reaſonably concluded from obſerving all Bones in a cartilaginous State before they oſſify; and from ſeeing, on the other Hand, ſo many Cartilages become bony: This may be ſtill farther confirmed, by the *Exfoliation* which Cartilages are ſubject to, as well as Bones; and a Demonſtration can be given of this Structure, after boiling, burning, and expoſing Cartilages to the Weather.

Veſſels and Nerves.

The Blood-veſſels and Nerves are diſtributed to the Cartilages, in much the ſame Manner as to the Bones.

While Cartilages are in a natural State, it is to be remarked; *Firſt*, That they have no Cavity in their Middle for Marrow. *Secondly*, That their exterior Surface is ſofteſt, which renders them more flexible; from this it is, that injected Liquors ſeldom reach to their mid-

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* Χονδροι.

middle ſolid Part, tho' the Veſſels on their Surface are eaſily filled. And *Laſtly*, That, as the ſpecifick Gravity of Cartilages is near a third leſs than that of Bones, ſo the Coheſion of their ſeveral Plates is not ſo ſtrong as in Bones, whence Cartilages when laid bare in a living Creature, by a Wound or Ulcer, are not only more liable to corrupt, but exfoliate much ſooner than Bones do.

Cartilages ſeem to be principally kept from Oſſifying, either by being ſubjected to alternate Motions of Flexion and Extenſion, the Effects of which are very different from any Kind of ſimple Preſſure, or by being conſtantly moiſtned; thus the Cartilages on the articulated Extremities of the great Bones of the Limbs, and the moveable ones placed between the moving Bones in ſome Articulations, which are obliged to ſuffer many and different Flexions, and are plentifully moiſtned, ſcarce ever change into Bone, while thoſe of the Ribs and Larynx are often found oſſified. In the Cartilages of the Ribs, again, we ſee that the middle angular Part, which is conſtantly in an alternate State of Flexion and Extenſion, by being moved in Reſpiration, never miſſes to be the laſt of becoming bony. And in the *Larynx*, the *Epiglottis*, which is oftner bended and more moiſtned than the other four Cartilages, ſeldom is oſſified, while the others as ſeldom eſcape it in Adults.

The Cartilages (unleſs when ſome of theſe Cauſes operate) begin to oſſify on their external Surface, where the greateſt Preſſure of numerous Veſſels, and of external Forces muſt be, and the Oſſification proceeds internally till the *Cancelli* are at laſt formed, when a ſort of Marrow is depoſited into them: While this Change is a bringing about in the Subſtance of the Cartilages, their Blood-veſſels gradually appear bigger towards their internal Subſtance, and leſs on the external. This Change of a Cartilage from a natural State to its becoming Bone is at firſt View ſurpriſing, and, ſo far as I know, has ſcarce been attempted to be explained; which I mention only, to have ſome Plea for an Apology, if I ſhould be thought to have failed in accounting for this *Phænomenon.*

Account of their Oſſification.

That we may be able to reaſon on ſome Principles, it will be neceſſary to add ſome more Obſervations of Facts to thoſe already mentioned. Such are the following: As the Plates of Cartilages ſeparate more eaſily than thoſe of Bones; ſo the Coheſion of the bony Plates is always ſtrong in Proportion to the Solidities of the Bones, as may be evidently ſeen in preparing different Bones of Adults, or the ſame Bones of young and old Subjects, in order to unravel their Texture, or by comparing the Time which ſuch Bones take to exfoliate. Next, I wou'd repeat what was formerly remarked, That as Creatures advance in Age, the ſolid Sides of the Bones ſtill turn firmer and harder, but thinner, and the *Cancelli* within them increaſe proportionally. Laſtly, That the hardning or Oſſification of Bones depends much upon the ſolid Particles being preſſed cloſer together, while the fluid ones are forced out.

The Cartilages being naturally of ſuch firm

Subſtance, and of a Compoſition a-kin to the Bones, will by a conſtant Preſſure gradually acquire greater Solidities; and this Change will be made ſooneſt and moſt remarkably, where this Preſſure is greateſt, that is, at their external Surface. The exterior Plates, when oſſified, are more compact and denſe than formerly, and therefore they will have a ſtronger Power of attracting thoſe in contact with them; while the Branches of Veſſels diſtributed to the firſt oſſified Plate, and thoſe that run in the Interſtices of the Fibres of this and of the Plate next to it, being now more compreſſed than formerly, will have a leſs Quantity of Fluids paſſing through them, and conſequently the other Branches will receive a proportionally larger Quantity; the *Momentum* of which, joined to that Power of Attraction or Force of Coheſion, increaſed by the greater Solidities of the Plates, will increaſe the Preſſure upon the more internal Plates, and haſten their hardning; after which theſe laſt Plates will produce the ſame Effects on the other contiguous to them: And thus the Oſſification muſt go on, till all are become bony. The Body thus changed, will have its former Dimenſions, or near ſo, becauſe its external Part oſſified firſt, and being rigid, yields little or nothing to the Powers that draw it towards the Axis of the Bone; but ſeeing the new Particles added from the circulating Fluids during the Oſſification, do not compenſate for the Condenſation which all the Particles undergo, and thereby the Plates occupy leſs Space than they did while in a cartilaginous State, therefore a Cavity will be left in the Middle; and as all the Plates cohered and had croſs Fibres joining them, many of theſe Fibres will be ſtretched irregularly from one Side of the Cavity to the other, and therefore form the *Cancelli*. The Branches of the Veſſels formerly diſtributed to the Plates being now much leſſened, the remaining Branches, which run tranſverſely, will conſequently be proportionally increaſed, come to be very conſpicuous, and are diſperſed every where in the Cavity, to ſerve for the Secretion of Marrow.

The Cartilages ſubſervient to Bones are, as *Celſus* (a) obſerves, ſometimes found on the Extremites of Bones which are conjoined to no other; but are never wanting on the Ends and in the Cavities of ſuch Bones as are deſigned for Motion: And in more than one Inſtance, Cartilages are interpoſed between ſuch other Cartilages as cover the Heads and Cavities of articulated Bones; nay they are alſo placed between immovable Bones. *Situation.*

The Uſes of Cartilages, ſo far as they regard the Bones, are, to allow by their Smoothneſs ſuch Bones as are deſign'd for Motion to ſlide eaſily without Detrition, while by their Flexibility they accommodate themſelves to the ſeveral Figures neceſſary in different Motions, and by their Elaſticity they recover their natural Poſition and Shape as ſoon as the Preſſure is removed: This ſpringy Force may alſo aſſiſt the Motion of the Joint to be more expeditious. To theſe Cartilages we chiefly owe the Security of the moveable Arti- *Uſes.*

(a) De Re medic. lib. 8. cap. 1.

Articulations: For without them the bony Fibres would ſprout out, and intimately coaleſce with the adjoining Bone; whence a true *Anchyloſis* muſt neceſſarily follow; which never fails to happen when the Cartilages are eroded, as was already obſerved. The moveable Cartilages interpoſed in Joints ſerve to make the Motions both freer and more ſafe than they would otherwiſe be. Thoſe placed on the Extremity of Bones that are not articulated, as on the Spine of the *Iliûm*, Baſe of the *Scapula*, *&c.* ſerve to prevent the bony Fibres to grow out too far. Cartilages ſometimes ſerve as Ligaments either to faſten together Bones that are immoveably conjoined, ſuch are the Cartilages between the *Os ſacrum* and Haunch-bones, the *Oſſa pubis*, *&c.* or to connect Bones that enjoy manifeſt Motion, as thoſe between the Bodies of the true *Vertebræ*, *&c.* And very often Cartilages do the Office of Bones to greater Advantage than theſe laſt could; as in the Cartilages of the Ribs, the Cartilages which ſupply Brims of Cavities, *&c.*

MUCILAGE.

The Liquor which principally ſerves to moiſten the Ligaments and Cartilages of the Articulations is ſupplied by Glands, which are commonly ſituated in the Joint after ſuch a Manner as to be gently preſſed, but not deſtroyed by its Motion. By this means, when there is the greateſt Neceſſity for this Liquor, that is, when the moſt frequent Motions are performed, the greateſt Quantity of it muſt be ſeparated. Theſe Glands are ſoft and pappy, but not friable: They are moſtly of the conglomerate

Kind, or a great Number of ſmall Glandules are wrapt up in one common Membrane. Their excretory Ducts are long, and hang looſe, like ſo many Fringes, within the Articulation; which by its Motion and Preſſure will prevent Obſtructions in the Body of the Gland, or its Excretories, and will promote the Return of this Liquor, when fit to be taken up by the abſorbent Veſſels, which muſt be in the Joints as well as in the other Cavities of the Body; and at the ſame time the Preſſure on the excretory Ducts hinders a ſuperfluous unneceſſary Secretion, while the fimbriated Diſpoſition of theſe Excretories will not allow any of the ſecreted Liquor to be puſhed back again by theſe Canals towards the Glands, as *Cowper (a)* has juſtly remarked. Beſides theſe conglomerate Glands, we meet ſometimes with ſmall ſimple *Folliculi*, obſerved by *Morgagni (b)*, that are full of Liquor.

Upon preſſing theſe Glands with the Finger, one can ſqueeze out of their Excretories a mucilaginous Liquor, which ſomewhat reſembles the White of an Egg or *Serum* of the Blood, but is manifeſtly ſalt to the Taſte. It does not coagulate by Heat, as the *Serum* does; but turns firſt thinner, and when evaporated, leaves only a thin ſalt Film. Different Salts have much the ſame Effect on it as on the other Juices of our Body; for *Acids* coagulate it, and *Alkalies* attenuate it. The Quantity of this *Mucilage* conſtantly ſupplied muſt be very conſiderable, ſince we ſee what a plentiful troubleſome Diſcharge of *Synovia* follows Wound or Ulcer of any Joint, of which Liquor the Mucilage is a conſiderable Part.

(a) Anatomy Explicat. tab. 79. litt. E, E.
(b) Adverſar. 2. animad. 23.

Veſſels. The Veſſels which ſupply Liquors for making the Secretion of this Mucilage are to be ſeen without any Preparation, but after a tolerable Injection of the Arteries the Glands are covered with them.

Nerves. In a ſound State we are not conſcious of any Senſibility in thoſe Glands; but in ſome Caſes which I have ſeen, when they inflame and ſuppurate, the moſt racking Pain is felt in them: A melancholy, tho' a ſure Proof of their Nerves.

Cellular fatty Subſtance. Theſe mucaginous Glands are commonly lodged in a cellular Subſtance; which is alſo to be obſerved in other Parts of the Bag formed by the Ligaments of the Articulation, and contains a fatty Matter, that muſt neceſſarily be attenuated, and forced through the including Membranes into the Cavity of the Joint, by the Preſſure which it ſuffers from the moving Bones.

Uſes. If then the Oil is conveyed from this cellular Subſtance, and if the attenuated Marrow paſſes from the *Cancelli* of the Bones by the large Pores near their Extremities or in their Cavities, and ſweats through the Cartilages there into the Articulations; which it may, when aſſiſted by the conſtant Heat and Action of the Body, more eaſily do, than when it eſcapes through the Compact Subſtance of the Bones in a Skeleton: If, I ſay, this Oil is ſent to a Joint, and is incorporated with the Mucilage, and with the fine

Lymph that is conſtantly ouzing out at the ſmall Arteries diſtributed to the Ligaments, one of the fitteſt *Liniments* imaginable muſt be produced; for the *Mucus* diluted by the Lymph contributes greatly to its Lubricity, and the Oil preſerves it from hardning. How well ſuch a Mixture ſerves the Purpoſe it is deſigned for, *Boyle (a)* tells us he experienced in working his Air-pump; for the Sucker could be moved with much leſs Force after being moiſtned with Water and Oil, than when he uſed either one or other of theſe Liquors: And I believe every one at firſt View will allow the diluted Mucilage to be much preferable to ſimple Water. This *Synovia*, as this Liquor compoſed of Oil and Mucilage is commonly called, will therefore, while in a ſound State, effectually preſerve all the Parts concerned in the Articulations ſoft and flexible, and will make them ſlide eaſily on each other, by which their mutual Detrition and Overheating may be prevented; in the Manner daily practiſed in Coach and Cart Wheels, by beſmearing them with Greaſe and Tar. After this Liquor of the Articulations becomes too thin and unſerviceable, by being conſtantly pounded and rubbed between the moving Bones, it is reaſſumed into the Maſs of Blood by the proper abſorbent Veſſels, which the Articulations have in common with all the other Cavities of the Body.

Diſeaſes.

When the *Synovia* is not rubbed betwixt the Bones, it inſpiſſates; and ſometimes when the Head of a Bone has been long out of its Cavity, this Liquor fills up the Place of the Bone, and hinders its Reduction; or if a Joint continues long unmoved, the *Synovia* cements the Bones, and occaſions a true *Anchyloſis*. *Ambroſe Parè* (a) ſays, he has frequently ſeen ſuch Caſes, and *Hildanus* (b) gives a particular Example of it. If the *Synovia* becomes too acrid, it erodes the Cartilages and Bones; as frequently happens to thoſe who labour under the *Lues Venerea*, *Scurvy*, *Scrophulæ* or *Spina ventoſa*. If this Liquor is ſeparated in too ſmall a Quantity, the Joint, as *Galen* (c) remarks, becomes ſtiff; and when with Difficulty it is moved, a crackling Noiſe is heard, as People advanced in Years frequently experience. This Sort of Diſeaſe *Aquapendente* (d) very accurately deſcribes, and rationally accounts for. If the Mucilage and Lymph are depoſited in too great a Quantity, and the abſorbent Veſſels do not their Office ſufficiently, they may occaſion a Dropſy of the Joints, which *Hildanus* (e) has at large treated of. From this ſame Cauſe alſo the Ligaments are often ſo much relaxed, as to make the Conjunction of the Bones very weak: Thence ariſe the Luxations from an internal Cauſe, which are eaſily reduced, but difficultly cured; and frequently when ſuch a ſuperfluous Quantity of this Liquor is pent up, it becomes very acrid, and occaſions a great

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(a) Phyſico-mechanic. Experim.

(a) Chirurgie, livre 15. chap. 18.

(b) Obſervat. cent. 3. obſ. 77.

(c) De uſu Part. lib. 12. cap. 2.

(d) De articul. part. utilitat. pars 3.

(e) De Ichore & Meliceria acri Celſi.

Train of bad Symptoms; ſuch as, Swelling and Pain of the Joints, long ſinuous Ulcers and *Fiſtulæ*, rotten Bones, Immobility of the Joints, *Marcor* and *Atrophia* of the whole Body, hectic Fevers, *&c.* Moſt of theſe Symptoms from the diſeaſed *Mucus* of the Joints *Hippocrates (a)* very accurately deſcribes, and *Hildanus (b)* gives the Hiſtories of a great many People labouring under them.

(a) De locis in homine & de articul.
(b) De Ichore & Meliceria acri Celſi.

THE ANATOMY OF THE *Human Bones.*

PART II.

Of the Skeleton.

SKELETON. ALL the Bones of an Animal, freed from the Teguments, Muſcles, Veſſels, Glands and *Viſcera*, and orderly connected, have the general Deſignation *Skeleton* *. This Term might indeed be applied to any dry Preparation, but is now by the common Conſent of Anatomiſts reſtricted to this Preparation of the Bones.

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* Cadaveris crates.

Of theſe *Skeletons* there are two Sorts; one natural, when the Bones are kept together by their own Ligaments; the other artificial, when they are joined with Wire, or any other Subſtance which is not Part of the Creature to which the Bones belonged. Small Subjects, and ſuch whoſe Bones are not fully oſſified, are commonly prepared the firſt Way; becauſe were all their Parts divided, the niceſt Artiſt could not rejoin them, by reaſon of their Smallneſs, and of the Separation of the unoſſified Parts; whereas the Bones of large adult Animals are ſooneſt and moſt conveniently cleaned when ſingle, and there is no great Difficulty in reſtoring them to, and keeping them firm in their former natural Situation. *Diſtinguiſhed.*

Sometimes we prepare the Skeletons of the ſame Animal in both theſe Ways, that is, we leave the ſmaller Bones joined by their natural Ligaments, and ſeparate the larger ones till they are cleaned, when they are again connected by Wires or ſome ſuch Subſtances.

Before we proceed to the Diviſion and particular Deſcription of the Skeleton, 'tis worth while to remark, that when the Bones are brought to the natural Situation, ſcarce any one of them is ſo placed as to be in a perpendicular Bearing to another; tho' the Fabrick compoſed of them is ſo contrived, that in an erect Poſture, a perpendicular Line from their common Center of Gravity falls in the Middle of their common Baſe. By this Contrivance we can ſupport ourſelves as firmly, as if the Axis of all the Bones had been a ſtraight Line perpendicular to the Horizon; and we have *Situation.*

have at the ſame time a much greater Facility and Strength in ſeveral of the moſt neceſſary Motions we perform. It is true indeed, that wherever the Bones, on which any Part of our Body is ſuſtained, decline from a ſtraight Line, the Force required in the Muſcles to counteract the Gravity of that Part is greater than otherwiſe it needed to have been; but then this is effectually provided for in ſuch Places by the Number and Strength of the Muſcles. As long therefore as we remain in the ſame Poſture, a conſiderable Number of Muſcles muſt be in a conſtant State of Contraction; which we know, both from Reaſon and Experience, muſt ſoon create an uneaſy Senſation. This we call being weary of one Poſture: An Inconvenience that we would not have had in ſtanding erect, if the Bearing of all the Bones to each other had been perpendicular; but is ſufficiently compenſated by the Quickneſs, Eaſe and Strength of a great Variety of other Motions, as was above hinted.

Divided. The human Skeleton is generally divided into the *Head*, *Trunk*, *ſuperior* and *inferior Extremities*.

Of the Head.

HEAD. BY the *HEAD* is meant all that ſpheroidal Part which is placed above the firſt *Vertebra* of the Neck. It therefore comprehends the *Cranium* and Bones of the *Face*.

Divided.

The

CRANIUM.

The *Cranium* *, Helmet or Brain-caſe, as the Word imports, conſiſts of ſeveral Pieces; which joined, form a vaulted Cavity for lodging and defending the Brain, *Cerebellum*, Membranes and Veſſels.

Cavity.

The Cavity of the *Cranium* is proportioned to its Contents. Hence ſuch a Variety of its Size is obſerved in different Subjects; and hence the Fore-part of the Scull, in which the anterior Lobes of the Brain are lodged, is neither ſo broad nor ſo deep as the poſterior Part, where the large poſterior Lobes of the Brain and the whole *Cerebellum* are contained.

Figure.

The roundiſh Figure of the Scull, which makes it more capacious and better able to defend its Contents from external Injuries, is chiefly owing to the equal Preſſure of theſe contained Parts, as they grow and increaſe before it is entirely oſſified. It is to be obſerved however, that in Adults the Sides of the *Cranium* are depreſſed below a ſpherical Surface by the ſtrong temporal Muſcles, whoſe Action hinders here the uniform Protruſion of the Bones, which is more equally performed in other Parts, where no ſuch large Muſcles are to be found. In Children, whoſe Muſcles have not acted much, and conſequently have not had great Effects on the Bones, this Depreſſion is not ſo remarkable; and therefore their Heads are rounder than in Adults. Theſe natural Cauſes differently diſ-

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* Κόγχος, κύτος, κώδεια, σκαφίον, calva, calvaria, cerebri galea, theca & olla capitis, teſta capitis, ſcutella capitis.

poſed in different People, may and do produce a great Variety in the Shapes of Sculls, which is ſtill increaſed by the different Management of the Heads of Children when very young: So that one may, with *Veſalius* (a), know a *Turk*'s Scull by its globular Figure, a *German*'s by its Breadth and Flatneſs of the *Occiput*, *Dutch* and *Engliſh* by their oblong Shapes, *&c.* Two Advantages are procured from this Flatneſs of the Sides of the *Cranium*, *viz.* the Enlargement of our Sphere of Viſion, and more advantageous Situation of our Ears, for receiving a greater Quantity of Sound, and for being leſs expoſed to Injuries.

Surfaces. *External.* The ſuperior external Surface of the *Cranium* is very ſmooth and equal, being only covered with the *Perioſteum*, (common to all the Bones, but in the Scull diſtinguiſhed by the Name of *Pericranium*,) the thin *frontal* and *occipital* Muſcles, their tendinous *Aponeuroſis*, and with the common Teguments of the Body; while the inferior external Surface is all over full of Riſings, Depreſſions and Holes, which afford a convenient Origin and Inſertion to the Muſcles that are connected to it, and allow a ſafe Paſſage for the Veſſels that run through and near it.

Internal. The internal ſuperior Part of the Scull is commonly ſmooth, except where the Veſſels of the *dura Mater* have made Furrows into it while the Bones were ſoft. Theſe Furrows ſhould make Surgeons cautious when they trepan here, leſt in ſawing or raiſing the Bone where ſuch Furrows are, they wound the Veſſels of the *dura Mater*. In the ſuperior internal Surface of ſeveral Sculls there are likewiſe Pits, of different Magnitudes and Figures, which ſeem to be formed by ſome Parts of the Brain more luxuriant and prominent than others. Where theſe Pits are, the Scull is ſo much thinner than any where elſe, that it is often rendred diaphanous, the two Tables being cloſely compacted without a *Diploe*; the Want of which is ſupplied by Veſſels going from the *dura Mater* into a great many ſmall Holes obſervable in the Pits. Theſe Veſſels are larger and much more conſpicuous than any others that every where are ſent from the *dura Mater* to the Scull, as evidently appears from the large Drops of Blood they pour out when the Scull is raiſed from the *dura Mater* in a recent Subject; and therefore they may afford a ſufficient Quantity of neceſſary Liquors, to prevent the Brittleneſs of this thin Part. The Knowledge of theſe Pits ſhould be a Caveat for Surgeons, who in the Operation of the Trepan, hurry on till they have pierced the firſt Table; ſince in a Patient whoſe *Cranium* is thus pitted, the *dura Mater* and Brain may be deſtroyed before the Inſtrument has pierced near the ordinary Thickneſs of the Scull. The internal Baſe of the Scull is extremely unequal, for lodging the ſeveral Parts and *Appendices* of the Brain and *Cerebellum*, aad allowing a Paſſage and Defence to the Veſſels and Nerves that go into or come out from theſe Parts.

(a) Lib. 1. cap. 5.

The Bones of the *Cranium* are compoſed of two bony Tables, and an intermediate *Tables.*

termediate cellular Subſtance, commonly called their *Diploe* *. The external Table is thickeſt; the inner, from its Thinneſs, and conſequent Brittleneſs, has got the Name of *Vitrea.* Whence we may know the Reaſon of ſuch miſchievous Conſequences ſo often attending a Collection of Matter in the *Diploe*, either from an external or internal Cauſe, before any Sign of ſuch a Collection appears in the Teguments that cover the Part of the Scull where it is lodged.

Diploe. The *Diploe* has much the ſame Tex- with the *Cancelli* of other Bones, and contains Marrow, which having numerous Branches of Veſſels ſpread on its Membranes, ſeems bloody. Theſe *Cancelli*, with their Marrow, ſerve the ſame Uſes here as they do in other Bones. I have found the *Diploe* in ſeveral old Subjects ſo obliterated, that ſcarce any Veſtige of it was to be ſeen; neither is it obſervable in ſome of the hard craggy Bones at the Baſe of the Scull. Hence another uſeful Caution to Surgeons, who truſt to the Blooding, Want of Reſiſtance, and Change of Sound, as certain Marks in the Operation of the Trepan, for knowing when their Inſtrument has ſawed through the firſt Table, and reached the *Diploe*.

Divided. The *Cranium* conſiſts of eight Bones, ſix of which are ſaid to be proper, and the other two are reckoned common to it and the Face. The ſix proper are the *Os frontis*, two *Oſſa parietalia*, *Bones.* two *Oſſa temporum* and the *Os occipitis*.

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* Meditullium, commiſſura,

The common are the *Os Ethmoides* and *Sphenoides.*

The *Os frontis* forms the whole anterior Part of the Vault, the two *parietalia* form the ſuperior and lateral Part, the *Oſſa temporum* compoſe the inferior Part of the Sides, the *Os occipitis* the whole poſterior Part and ſome of the Baſe, *Os Ethmoides* is placed in the anterior Part of the Baſe, and the *Sphenoides* in the Middle of it.

Theſe Bones are joined to each other by five *Sutures*; the Names of which are the *Coronal*, *Lambdoid*, *Sagittal*, and two *Squamous*. *Sutures. Proper.*

The *Coronal* * runs upward, acroſs and over the Head, from within an Inch or ſo of the external *Canthus* of one Eye, to the like Diſtance from the other, which is much the ſame Place where the *Romans* wore their *Vittæ*, *Coronæ*, or Garlands; whence this Suture has got its Name. 'Tis to be remarked, That for an Inch or more, at the inferior Part of this Suture on each Side, the Indentations which are ſo evident thro' the reſt of it, are not obſervable; but this Articulation becomes plainly ſquamous and very ſmooth, by the parietal mounting on the frontal Bone, and by the two being accurately applied to each other. This we may believe proceeds from the Action of the temporal Muſcles, becauſe Bones are alſo ſmooth elſewhere, when Bellies of Muſcles cover them. The Muſcles, by this Mechaniſm, are leſs expoſed *Coronal.*

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* Στεφαναῖα, Arcualis, Puppis.

poſed to any Harm from ſharp Points or unequal Surfaces of the Bones.

Lambdoid. The *Lambdoidal* * *Suture*, begins ſome way below, and farther back than the *Vertex* or Crown of the Head, whence its two Legs are ſtretched obliquely down and to each Side, in Form of the *Greek* Letter Λ, and are now generally ſaid to extend themſeeves to the *Baſe* of the Scull; but the old Anatomiſts reckoned the proper *Lambdoid* Suture to terminate at the *Squamous* Sutures, aud what is extended at an Angle down from that, they called *Additamentum ſuturæ Lambdoidis* †.

Oſſa triquetra. This *Suture* is often very irregular, ſeeming to be made up of a great many ſmall Sutures, which ſurround ſo many little Bones, that are generally larger and more conſpicuous on the external Surface of the Scull, than internally. Theſe had the Name of *Triquetra* beſtowed on them by their firſt Diſcoverers, who it ſeems found ſome of them approaching to a triangular Figure, but for the moſt Part, they are far from ſuch a Shape. They are alſo called *Wormiana*, from *Olaus Wormius* the *Dane*, who, beſides the larger ones reckoned Specificks in the Epilepſy, demonſtrated *(a)* ſeveral ſmall Bones of this Kind, that were generally overlooked by his Cotemporaries, but ſeem to be both deſcribed and painted by many Authors who wrote before him. The Formation of the *Oſſa Triquetra*, is owing to the Bones betwixt which they are fonnd, becoming too ſolid before their bony Fibres meet, and therefore not being capable to be ſtretched ſo far as they ought, for then the middle Space which remains unoſſified, begins to aſſume a bony Nature at ſeveral diſtinct Points that gradually enlarge, and at laſt, each of theſe bony Pieces is indented into the larger Bones and into each other. Probably thoſe Children, who have a large opening in this Place at their Birth, will have the largeſt *Oſſa Triquetra*. To confirm this Account I have given of the Formation of theſe little Bones, we may remark, that ſuch Bones are ſometimes ſeen in other Sutures as well as in the *Lambdoid*. *Veſalius (a)* paints one at the Meeting of the *ſquamous* and *ſphenoid* Sutures; *Paaw (b)* tells us he ſaw that Part of the *parietal* and *frontal* Bones, where the *Fontanelle* is in Children, ſurrounded with a Suture; *Ruyſch (c)* relates four Examples of ſuch Bones in the *Sutura Squamoſa*, three in the *Coronal*, and two between the *Os Frontis* and *Sphenoides*; ſome ſuch Examples are alſo related by *Bartholin (d)*; and I have ſeen ſeparate diſtinct Bones at the Conjunction of the *Ethmoid* and *Sphenoid*, of the *ſphenoid* and *parietal* Bones, and in the *Coronal* Suture.

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* Laudæ, Proræ, Hypſyloides.

† *Lambdoides harmonialis, Lambdoides inferior, Occipitis Cornua.*

(*a*) Muſæum lib. 3. cap. 26.

Sagittal.

The *Sagittal* Suture *, runs exactly in the middle of the ſuperior Part of the Scull, and for the moſt Part, terminates at the middle of the *Coronal* and of the *Lambdoid* Sutures, between which it ſeems placed as an Arrow is, when fully drawn, between the String and Bow: However this Suture is frequently continued through the Middle of the *Os Frontis*, down to the Root of the Noſe; and according to *Riolan (a)* this oftner happens in Women than Men, but is ſaid by *Veſalius (b)* to be met with more frequently in Male Sculls than in Female: Each have their Partizans, and probably thoſe Authors, who have not blindly followed the Authority of former Writers, have given their Opinion according to the Difference in the Sculls examined by them. Among the Sculls which I have ſeen thus divided, the Female are the moſt numerous. *Veſalius (c)*, *Paaw (d)*, and *Lauren* *(e)* have delineated and deſcribed the *Sagitta* Suture ſometimes dividing the *occipital* Bon as far down as the great Hole through which the *Medulla ſpinalis* paſſes; this I never ſaw nor ſuch a double ſagittal Suture as *Euſtachiu* *(f)* mentions.

(a) Lib. 1. cap. 6. fig. 4.
(b) In Hippocrat. de Capit. vuln.
(c) Muſæum Anat.
(d) Hiſt. anat. Cent. 1. hiſt 51.
* Ῥαβδοειδὴς, ὀβελιαία, ἐπιζευγνῦσα, Inſtar virgæ, nervalis,

In ſome old Sculls which are in my Poſſeſſion, ſcarce a Veſtige of any of theſe thre *Sutures* already deſcribed, is to be ſeen. In other Heads, one or two of the Sutures onl diſappear; but I never could diſcover an Rea

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nervalis, inſtar teli, inſtar veru, ſecundum capitis longitudinem prorepens, conjungens, columnalis, recta, acualis.

(*a*) Anat. Sect. 2. cap. 19.

(*b*) Lib. 1. cap. 6. & in Epitome.

(*c*) Lib. 1. cap. 5. fig. 3. 4. & in text, cap. 6.

(*d*) In Cels. de re medic. cap. 1.

(*e*) Hiſt. anat. lib. 2. cap. 16.

(*f*) Oſſium examen.

Reaſon for thinking them diſpoſed in ſuch different Manners in Sculls of different Shapes as *Hippocrates* (*a*) and *Galen* (*b*) alledge they are.

Squamous.

The *Squamous Agglutinations* or *Falſe Sutures* * are one of each Side, a little above the Ear, of a ſemicircular Figure, formed by the overloping (like one Scale upon another) of the ſuperior Part of the *temporal* Bones on the inferior Part of the *parietal*, where there are in both Bones, a great many very ſmall Riſings and Furrows, which are indented into each other, tho' theſe Inequalities do not appear till the Bones are ſeparated. In ſome few Sculls indeed, *Columbus* (*c*) and *Dionis* (*d*) have juſtly remarked the Indentations here to be as conſpicuous externally as in other Sutures; and what is commonly called the poſterior Part of this ſquamous Suture, always has the evident ſerrated Form, and therefore is reckoned by ſome a diſtinct Suture, under the Name of *Additamentum poſterius ſuturæ ſquamoſæ*.

We ought here to remark with *Veſalius* (*e*) and *Winſlow* (*f*), that the true ſquamous Sort of Suture is made uſe of, to join all the Edges of the Bones on which the temporal Muſcles are placed, and is not confined to the Conjunction

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(*a*) De vulner. Capitis.

(*b*) De oſſib. cap. 1. & de uſu Part. lib. 9. cap. 17.

* Λεπιδοειδῆ προσκολλήματα, κροταφίαι, Temporales, Corticales, Mendoſæ, Harmoniales, Commiſſuræ in unguem.

(*c*) De re Anat. lib. 1. cap. 4.

(*d*) Anatomie 3· Demonſtr. des Os.

(*e*) Anat. lib. 1. cap. 6.

(*f*) Memoires de l'Acad. des Sciences 1720.

ction of the temporal and parietal Bones: For the two Parts of the ſphenoidal Suture which are continued from the anterior Extremity of the common ſquamous Suture juſt now deſcribed; of which one runs perpendicularly down, and the other horizontally forwards; and alſo the lower Part of the coronal Suture already taken Notice of, may all be juſtly ſaid to pertain to the ſquamous *Suture.* The Manner how I imagine this Sort of Suture is formed at theſe Places is, That by the Action of the ſtrong temporal Muſcles on one Side, and by the Preſſure of the Brain on the other, the Bones are made ſo thin as to allow no other Suture; and then the *ſquamous* Form is more convenient here, becauſe ſuch thin Edges of Bones being accurately applied one to another, have ſcarce any rough Surface, to hinder or hurt the Muſcle in its Contraction; which is ſtill further provided for, by the Manner of laying theſe Edges on each other; for in viewing them externally, we ſee the temporal Bones covering the ſphenoidal and parietal, and this laſt ſupports the ſphenoidal, while both mount on the frontal; from which Diſpoſition of the Edges of the Bones, it is evident, that when the temporal Muſcle is contracting which is the only Time it preſſes ſtrongly in its Motion on the Bones, its Fibres ſlide over the external Edges ſmoothly. Another Advantage ſtill in this Mechaniſm is, that all this bony Part is made ſtronger by the Bones thus ſupporting each other.

Common Sutures.

The Bones of the Scull are joined to one another, and to thoſe of the Face, by the Means of theſe other five Sutures, *Ethmoidal*, *Sphenoidal*, *Tranſverſe*, and two *Zygomatic*.

Ethmoidal. Sphenoidal.

The *Ethmoidal* and *Sphenoidal* ſurround the Bones of theſe Names; and in ſome Places help to make up other Sutures, particularly the *Squamous* and *Tranſverſe*; and in other Parts, there is but one Suture common to theſe two Bones.

Tranſverſe.

The *Tranſverſe* Suture runs quite croſs the Face, from the external *Canthus* of one Orbit to the ſame Place of the other, by ſinking from the *Canthus* down the outſide of the Orbit to its Bottom; then mounting upon the Inſide, it is continued by the Root of the Noſe down the internal Part of the other Orbit, and up again to the other *Canthus*. It might be here remarked, that there are ſome Interruptions of this Suture n this Courſe I have deſcribed, by the Bones not being joined every where, but being ſeparated, to leave Holes which are afterwards to be mentioned.

Zygomatick.

The *Zygomatic* Sutures are one of each Side, being ſhort and ſtretched from above, obliquely downwards and backwards, to join the poſterior Proceſs of the Cheek-bone to the Proceſs of the *Os temporum*, which advances towards the Face; ſo that the two Proceſſes thus united, form a Sort of Bridge, not unlike the *Jugum* of the Ancients, under which the *temporal* Muſcle paſſes.

It muſt be here obſerved, that the Indentations of the *Sutures* do not appear any where on the Inſide of the *Cranium*, near ſo ſtrong as on the Outſide, but the Bones ſeem almoſt conjoined in a ſtraight Line; nay in ſome Sculls, the internal Surface is found entire, while the Sutures are manifeſt without. *Winſlow (a)* proves, that by this Mechaniſm, there is no Risk of the ſharp Points of the Bones growing inwards, ſince the external *Serræ* of each of the conjoined Bones, reſt upon the internal ſmooth-edg'd Table of the other Bone; and the Bones will hence better reſiſt any external Force at theſe Parts, becauſe the Sutures cannot yield, unleſs the ſerrated Edges of the one Bone, and the plain internal Plate of the other are both broke.

The Manner how theſe Sutures are formed, was explained in the general Hiſtory of the Bones.

Uſes. The Advantages of the Sutures of the *Cranium* are theſe. 1. That this *Capſula* is more eaſily formed and extended into a ſpherical Figure, than if it had been one continued Bone. 2. That in the Birth, as the Bones are at ſome Diſtance from each other, they might, by yielding, allow to the Head a Change of Shape, accommodated to the Paſſage it is engaged in. Whence in hard Labour of Child-bed, the Bones of the *Cranium*, inſtead of being only brought contiguous, are ſometimes made to mount one on the other: A remarkable Inſtance of this Kind I had Occaſion to ſee in an Infant, one of whoſe *Oſſa parietalia* overloped the other, and both were riding on the *Os occipitis*, which occaſioned a redneſs and ſwelling in all the external Parts of the Head, accompanied with either a conſtant crying and toſſing, or drowſy doſing and Inſenſibility. Theſe Symptoms went off in a few Hours after I had reduced the Bones to their natural Place. 3. With a view to the Sutures allowing ſome Tranſpiration of Steams from the Brain, which was the old Doctrine; or ſome Communication of the Veſſels without and of thoſe within the Scull, larger here than in any other Part of the *Cranium*, according to ſome Moderns, Phyſicians continue to order *Cucuphæ*, *Fomentations*, *Cataplaſms*, *cephalick Plaiſters*, *Bliſters* to be applied, and *Iſſues* to be eroded or cut in the Head, at thoſe Places where the Sutures are longeſt in forming, and where the Connection of the Bones is afterwards looſeſt for the Cure of a *Phrenitis*, *Mania*, *inveterate Head-ach*, *Epilepſy*, *Apoplexy*, and other Diſeaſes of the Head. This Doctrine of Tranſpiration or Communication of Veſſels at the Sutures has occaſioned ſtrong Diſputes. If ſome Obſervators have not been ſo far byaſſed in its Favour, as to impoſe their Opinion inſtead of Facts, there would appear to be ſome Ground for this Doctrine. *Columbus (a) Verduc (b)* and *Dionis (c)* relate Obſervations of Perſons whoſe Sutures were too cloſely united, and who had been ſubject to Head-aches, which at laſt were mortal. A fourth Uſe of the Sutures is, that the *dura Mater* may be more firmly ſuſpended by its Proceſſes which inſinuate themſelves into this Conjunction of the

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(a) Memoires de l' Acad. des Sciences, 1720.

Bones;

(*a*) De re Anat. lib. 1. cap. 5.
(*b*) Nouvelle Oſteologie chap. 14.
(*c*) Anatomie 3. demonſtr. des Os.

Bones; for doing this more equally, and where the greateſt Neceſſity of Adheſion is, the Sutures are diſpoſed at pretty equal Diſtances, and the large *Reſervoires* of Blood the *Sinuſes* are immediately under or near them. 5. That by this Contrivance, Fractures might be prevented from reaching ſo far as otherwiſe they would. 6. The Separation of the Bones, by the Sutures yielding, has evidently afforded great Relief in ſome Diſeaſes (*a*), and poſſibly in others may have prevented the very ill Conſequences which might have been expected from ſuch a Force puſhing the Brain from within outwards as could force the Bones aſunder; tho' in moſt of them this Separation of the Sutures was blamed for the violent Pain which the Patients ſuffered (*b*).

After conſidering thus the general Structure of the *Cranium*, I now proceed to examine more particularly the ſeveral Bones of which that Brain-caſe conſiſts: The firſt mentioned in the Enumeration of them was the

Os frontis. *OS FRONTIS* *; ſo named, becauſe it is the only Bone of that Part of the Face we call the *Forehead*, tho' it reaches a good deal further. It has much the ſame Shape with the

Shell

(*a*) Ephemerid. Germanic. Dec. 1. Ann. 4 & 5. Obſerv. 33.

(*b*) Ibid. Dec. 2. Ann. 9. Obſerv. 230. Ibid. Cent. 10. Obſ. 31. Vander Linden Medicin. Phyſiolog. Cap. 8. Art. 4. § 16. Hildan. Obſerv. Cent. 1. Obſ. 1. Pechlin. Obſerv. Lib. 2. Obſerv. 40.

* Μετώπȣ, *βρέγμα*, Coronale, Inverecundum, Puppis, ſenſus *communis*, quibuſdam Sincipitis.

Shell of the *Concha bivalvis*, commonly called the Cockle; for the greateſt Part of it is convex externally, and concave internally, with a ſerrated circular Edge, while the ſmaller Part, by reaſon of its Proceſſes and Depreſſions, has no regular Figure.

External Surface.

Proceſſes.

The external Surface of the *Os frontis* is perfectly ſmooth at its upper convex Part; but ſeveral Proceſſes and Cavities are obſervable below: For at each Angle of each Orbit, the Bone jets out to form four Proceſſes, two internal, and as many external, which from this Situation, may well enough be named *angular*. Between the internal and external angular Proceſſes of each Side, an arched Ridge is extended, on which the Eye-brows are placed. And very little above the internal Extremity of theſe *ſuperciliary* Ridges, a Protuberance may be remarked in moſt Sculls, where the Bone is protruded to make Place for two large Cavities, of which hereafter. Betwixt the internal angular Proceſſes, a ſmall Proceſs riſes, which forms ſome Share of the Noſe, and thence is named *Naſal*. Some obſerve a protuberant Part on the Edge of the Bone behind each external angular Proceſs, which they call *temporal* Proceſſes; but theſe are inconſiderable. From the Under-part of the ſuperciliary Ridges, the frontal Bone runs a great Way backwards, which Parts may juſtly enough be called *Orbitar* Proceſſes. Theſe are, contrary to the reſt of this Bone, externally concave for receiving the Globes of the Eyes with their Muſcles and Fat.

In

Cavities. In each of the *orbitar* Proceſſes behind the Middle of the ſuperciliary Ridges, a conſiderable Sinuoſity is obſerved, where the *Glandula innominata Galeni* or *lacrymalis* is lodged; and behind the internal angular Proceſſes, a ſmall Pit may be remarked, where the Cartilaginous Pully of the *Muſculus obliquus major* is fixed. Betwixt theſe two orbitar Proceſſes, a large Diſcontinuation of the Bone is to be ſeen, into which the cribriform Part of the *Os Ethomoides* is incaſed; the frontal Bone frequently has little Caverns formed into it here where it is joined to the Ethmoid Bone. Behind the external angular Proceſſes, the Surface of the Frontal Bone is conſiderably depreſſed, where Part of the *temporal* Muſcle is placed.

Foramina. The *Foramina*, or Holes, obſervable on the external Surface of the frontal Bone, are three of each Side; one in each ſuperciliary Ridge, a little removed from its Middle towards the Noſe. Thro' this Hole a Twig of the *Opthalmick* Branch of the fifth Pair of Nerves paſſes out of the Orbit, with a ſmall Artery from the Carotid, to be diſtributed to the Teguments and Muſcles of the Forehead. Theſe Veſſels in ſome Sculls make Furrows in the *Os frontis*, eſpecially in the Bones of Children, as *Ruyſch* *(a)* has alſo well obſerved of another conſiderable Veſſel of this Bone near its Middle; and therefore, we ought in ſuch to beware of tranſverſe Inciſions on either Side of the *Os frontis*, which might open theſe Veſſels, while they

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(*a*) Mus. Anat, Theca D. Repoſit. 4. N°. 3.

hey are yet in Part lurking within the Bone; for in ſuch a Caſe, 'tis difficult to ſtop an Hemorrhagy, becauſe the Adheſion of the Artery to the Bone, hinders its Contraction, and conſequently Stypticks can have little Effect; the Sides of the Furrow keep off compreſſing Subſtances from the Artery, and we would wiſh to ſhun Cauteries or Eſcharoticks, becauſe they make the Bone carious. But to return to the *ſuperciliary Foramina*, we muſt remark, that often inſtead of a Hole, a Notch only is to be ſeen: Nay, in ſome Sculls, ſcarce a Veſtige even of this is left; in others both Hole and Notch are obſervable, and that when the Nerve and Artery run ſeparately. Frequently a Hole is found on one Side, and a Nich on the other; at other Times we ſee two Holes; or there is a common Hole without, and two diſtinct Entries internally. Near the Middle of the internal Side of each Orbit, hard by, or in the *Sutura tranſverſalis*, there is a ſmall Hole left for the Paſſage of the naſal Twig of the firſt Branch of the fifth Pair of Nerves. This Hole is ſometimes intirely formed in the *Os frontis*; otherwhiles, the Sides of it are compoſed of this laſt Bone and of the *Os planum*. 'Tis commonly known by the Name of *Orbiter internus*, tho' *anterior* ſhould be added, becauſe of the next, which is commonly omitted. This, which I call *Orbiter internus poſterior*, is ſuch another as the former, only ſmaller, and an Inch or ſo deeper in the Orbit: Through it a ſmall Artery ſent from the internal *Carotid*, before it pierces the *dura Mater*, paſſes to the Noiſe. Beſides theſe ſix, there are a great Number of ſmall Holes obſervable on the external Surface of this Bone, particularly in the two Protuberances above the Eye-brows, under which the *Sinuſes* are. Moſt of theſe penetrate no further than the *Sinuſes* or *Diploe*, if the *Sinuſes* are wanting; tho' ſometimes I have ſeen this Bone ſo perforated by a vaſt Number of theſe ſmall Holes, that when looked at between ones Eye and a clear Light, it appeared like a Sieve; and in the Orbit of the Generality of *Skeletons*, we may obſerve one, two, or more Holes, which allow a Paſſage to a Hog's Briſtle through the Scull. The Place, Magnitude or Number of theſe however is uncertain: They generally ſerve for the Tranſmiſſion of ſmall Arteries or Nerves.

Internal Surface. The *Os frontis* is internally concave, except at the orbitar Proceſſes, which are convex internally to ſupport the anterior Lobes of the Brain. The internal Surface of this Bone is not ſo ſmooth as the external; for in the lateral and poſterior Parts, the larger Branches of the Arteries of the *dura Mater* make ſome Furrows. The Sinuoſities from the luxuriant Riſings of the Brain, mentioned when deſcribing the general Structure of the *Cranium*, are often very obſervable on the ſuperior Part of this internal Surface; and its anterior and inferior Parts are marked with the Contorſions of the anterior Lobes of the Brain. Through the Middle of this internal Surface, where always in Children, and frequently in old People the Bone is divided, either a Ridge ſtands out, to which the Superior Edge of the *Falx* is faſtned, or a Furrow runs, in which the upper Side of the he ſuperior longitudinal *Sinus* is lodged; on both theſe Accounts chirurgical Authors juſt-y diſcharge the Application of the Trepan here. The Reaſon of this Difference in Sculls is alledged by ſome Authors to be his, That in thin Sculls the Ridge ſtrengthens the Bones, and in thick ones there is no occaſion for it. To this way of accounting For this Phænomenon, it may juſtly be obected, that generally very thick Sculls have a large Spine here, and frequently thin ones have only a Furrow. Perhaps this Variety may be owing to the different Times of a complete Oſſification of theſe Parts in different Subects: For if the two Sides of this Bone meet before they arrive at their utmoſt Extent of Growth, they will unite very firmly, and all heir Fibres endeavour to ſtretch themſelves out where the leaſt Reſiſtance is, that is, beween the Hemiſpheres of the Brain. To ſupport this Reaſoning we may remark, that thoſe Adults, whoſe frontal Bone is divided by the ſagittal Suture, never have a Ridge in this Place.

Foramen.

Immediately at the Root of this Ridge or Furrow there is a ſmall Hole, which ſometimes pierces hrough the firſt Table, otherwhiles opens ino the ſuperior *Sinus* of the *Ethmoid* Bone within the Noſe. In it a little Proceſs of the *Falx* is lodged, and a ſmall Artery, and ſomeimes a Vein runs, as *Morgagni (a)* has taken notice; and the ſuperior longitudinal *Sinus* begins here. This Hole however is often not entirely proper to the *Os frontis*; for in ſeveral Sculls I obſerve, with *Ingraſſias (a)*, the inferior Part of it formed in the ſuperior Part of the Baſe of the *Criſta Galli*, which is a Proceſs of the *Os Ethmoides*.

(a) Adverſar, 6. animad. 31.

Subſtance. The *Os frontis* is compoſed of two Tables and an intermediate *Diploe*, as the other Bones of the *Cranium* are, and in a middle Degree of Thickneſs between the *Os occipitis* and *parietalia*, is pretty equally denſe all through, except at the orbitar Proceſſes, where, by the Action of the Eye on one Side, and Preſſure of the Lobes of the Brain on the other, it is made extremely thin and diaphanous, and the *Meditullium* is entirely obliterated. Since in this Place there is ſo weak a Defence for the Brain, it may be a Reaſon why Fencers juſtly eſteem a Puſh in the Eye ſo mortal *(b)*.

Sinus. The *Diploe* is alſo exhauſted in tha Part above the Eye-brows where th two Tables of the Bone ſeparate, by the external being protruded outwards, to form two large Cavities, which obtain the Appellation of *Sinus frontales*. Theſe are divided b a middle perpendicular bony Partition. Thei Capacities in the ſame Subject are ſeldom equal, tho' it is hard to determine, whether th Right or Left is moſt frequently largeſt: An in different Bones their Size is as inconſtant; nay I have examined ſome, where they wer entirely wanting, which oftner happens in ſuch

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(*a*) Comment. in Galen. de Oſſib. cap 1. comment.

(*b*) Ruyſch Obſerv. Anat. Chir. Obſerv. 54.

as have a flat Fore-head, and whoſe ſagtital Suture is continued down to the Noſe, than n others, as *Fallopius (a)* has remarked; and in Children they are never ſeen. In ſome Sculls, beſides the large oſſeous *Septum*, there are found in each *Sinus* ſeveral bony Pillars, or ſhort Partitions; in others theſe are wanting. For the moſt part the middle *Septum* is entire; other times it is diſcontinued, and the two *Sinuſes* communicate. When the *Sinuſes* are ſeen in ſuch Sculls as have the frontal Bone divided by the ſagittal Suture, the Partition dividing theſe Cavities is evidently compoſed of two Plates, which eaſily ſeparate. Each *Sinus* commonly opens by a roundiſh ſmall Hole, at the internal and inferior Part of the internal angular Proceſſes, into a *Sinus* formed in the Noſe at the ſuperior and poſterior Part of the *Os unguis*; near to which there are alſo ſome other ſmall *Sinuſes* of this ſame Bone, obſerved by Mr. *Cowper (b)*, the greater Part of which open ſeparately nearer the *Septum narium*, and often they terminate in the ſame common Channel with the large ones.

In a natural ſound State theſe Cavities are of conſiderable Advantage; for the *Uſes.* Organ of Smelling being thus enlarged, the *Effluvia* of odorous Bodies will more difficultly eſcape it: Then, theſe and the other Cavities which open into the Noſe, increaſe the Sound of our Voice, and render it more melodious, by ſerving as ſo many Vaults to

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(*a*) Expoſit. de Oſſibus, cap. 13.

(*b*) Drake's Anthropolog. Book 3. Chap. 10.

reſound the Notes. Hence People labouring under a *Coryza*, or ſtopping of the Noſe from any other Cauſe, when they are by the Vulgar, tho' falſely, ſaid to ſpeak through their Noſe, have ſuch a diſagreeable harſh Voice.

From the Deſcription of theſe *Sinuſes*, 'tis evident how uſeleſs, nay how pernicious it muſt be, to apply a Trepan on this Part of the Scull: For the Trepan, inſtead of piercing into the Cavity of the *Cranium*, would reach no further than the *Sinuſes*; or if it was puſhed on through the inner Table, any extravaſated Blood that happened to be within the Scull would not be diſcharged outwardly, but would fall into the *Sinuſes*, there to ſtagnate, corrupt and ſtimulate the ſenſible Membranes, from which alſo there would be ſuch a conſtant drilling of a glairy Mucus as would retard if not hinder a Cure, and wou'd make the Sore degenerate into an incurable *Fiſtula*. Beſides, as it would be almoſt impoſſible in this Caſe to prevent the Air paſſing thro' the Noſe from having conſtant Acceſs to the *dura Mater* or Brain, ſuch a Corruption would be brought on theſe Parts as wou'd be attended with great Danger. Further, in Reſpiration the Air ruſhing violently into theſe Cavities of the *Os frontis*, and paſſing thro' the external Orifice whenever it was not well covered and defended (as *Paaw* (a) and *Palfyne* (b) tell us it did in their Patients) would not only prevent the cloſing up of the external Orifice, but might otherwiſe bring on bad Conſequences. *Palfyn*'s Apothecary of *Lovain* was ſo oppreſſed when ever the ſmall external Paſſage into one of theſe *Sinuſes* was left open, that he deſpaired of living unleſs he cou'd cure it up.

(a) De Oſſibus Parſ. 1. Cap. 7.

(b) Anatomie chirurg. Traitè 4. Chap. 15. Nouvelle Oſteologie Partie 2. Chap. 3.

Connexion.

The *Os frontis*, at its ſuperior circular Part, is joined from one Temple to the other, by the coronal Suture, to the *Oſſa parietalia*; from the Termination of the coronal Suture to the external angular Proceſſes, the *ſphenoidal* Suture connects it to the Wedge-like Bone; at the external *Canthi* of the Eyes, its angular Proceſſes are joined by the tranſverſe Suture to the *Oſſa malarum*, to which it adheres one third down the external Part of the Orbits; whence to the Bottom of theſe Cavities, and a little up on the internal Sides, theſe orbitar Proceſſes are connected to the *ſphenodal* Bone by means of that ſame Suture. In ſome few Sculls however there appears at the ſuperior Part of the long Slit, at the Bottom of the Orbit, a Diſcontinuation of theſe two Bones. At the internal Side of each Orbit, the orbitar Proceſs is indented between the *cribriform* Part of the *ethmoid* Bone, and the *Os planum* and *unguis*; and afterwards the tranſverſe Suture joins this Bone to the ſuperior naſal Proceſſes of the *Oſſa maxillaria ſuperiora*, and to the *Oſſa naſi*. And *Laſtly*, Its naſal Proceſs is connected to the naſal *Lamella* of the *ethmoid* Bone.

Uſes.

The *frontal* Bone ſerves to contain, defend and ſuſtain the anterior Lobes of the Brain. It forms a conſiderable Part of the Cavities that contain the Globes of the Eyes, helps to make up the *Septum na-*

rium, Organ of Smelling, *&c.* From the Deſcription of the ſeveral Parts, the other Uſes of this Bone are evident.

Of Infants. In a Child born to the full Time the frontal Bone is divided through the Middle: The ſuperciliary Holes are not formed; often a ſmall round Piece of each orbitar Proceſs, behind the ſuperciliary Ridge, is not oſſified, and there is no *Sinus* to be ſeen within its Subſtance.

OſſaParietalia. *OSSA PARIETALIA* *. Theſe two Bones have got the Name of *Parietalia*, becauſe they ſerve like two ſtrong Walls to defend the *Encephalon*. They are alſo called *Oſſa bregmatis*, becauſe the *Fontanella*, or *Fons pulſatilis* †, obſervable here in Children before theſe Bones are entirely oſſified, makes this Place appear to the Touch always moiſt. Hence the Ancients alledged the ſuperfluous Moiſture of the Brain was evacuated this Way. Here by the way an uſeful Obſervation in Midwifery may be taken notice of, That if in time of Labour the ligamentous Membrane which covers the *Fontanelle* is firm and ſtretched, and the Pulſation of the Arteries is felt below it, 'tis a certain Proof the Child is alive; but if on the contrary the Membrane is ſhriveled and flaccid, and no Pulſation is felt, then there is Reaſon to think that the Child is dead: For as the Want of the Bone is only ſupplied by this Membrane, the Pulſation of the Veſſels below is eaſily perceived, while the Diſtenſion of theſe Veſſels keeps the Membrane ſtretched: As ſoon therefore as after Death theſe are emptied, both Pulſation and Tenſion diſappear. When the Condition of the Child is known, the Operator can determine what the Method of treating his Patient ſhould be. However it muſt be remarked, that the greateſt Share of this Opening is formed in the *Os frontis*, which therefore might more juſtly claim the Name. The Bone is generally thinner all the Life at this Part, than any where elſe; but after ſeven Years of Age, ſeldom any unoſſified Part is left: *Bauhin (a)*, *Bartholin (b)* and *Diemerbroek (c)*, affirm their having obſerved this opening in Adults, which I never ſaw; tho' *Kerckringius (d)* aſſures us it is no uncommon Caſe, giving for his Reaſon, that he had ſeen it in ten different People. Phyſicians, by preſcribing Applications to this particular Part preferably to any other, in internal Diſeaſes of the Head, ſeem ſtill to believe that a Derivation of noxious Liquors from the Brain, or a more effectual Operation of Medicines applied externally, can be more eaſily procured this Way, than at any other Part of the *Cranium*.

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* Κορυφῆς, Paria, ſyncipitis, verticis, arcualia, nervalia, cogitationis, rationis, bregmatis, madefactionis.

† Palpitans vertex, foliolum, folium, triangularis lacuna.

Each of the *Oſſa parietalia* is an irregular ſquare Bone, the ſuperior and anterior Sides being longer than the poſterior and inferior. This laſt Side is a con- *Figure.*

cave

(*a*) Theatr. Anatom. lib. 3. cap. 6.
(*b*) Anatom. lib. 4. cap. 6.
(*c*) Anatom. lib. 9. cap. 6.
(*d*) Oſteogenea fœtuum, cap. 2.

cave Semicircle, the middle Part giving way to the ſuperior round Part of the temporal Bone, while the two Extremities are ſtretche out: That behind, to join the poſterior thick Part of the temporal Bone, and the *Os occipitis* and the anterior to meet the *ſphenoid* Bone: This laſt is ſo large, as to have the Appearance of a Proceſs.

External Surface.

The external Surface of the *Oſſ* *parietalia* is convex, and upon it between the anterior and poſterio Sides, ſomewhat below the middl Height of the Bone, there riſes an arche Ridge, of a whiter Colour generally than an other Part of the Bone; from which, in Bone that have ſtrong Prints of Muſcles, a grea many converging Furrows run down like ſ many *Radii* from a Circumference towards Center. To the Ridge of each Bone the Origin of the temporal Muſcle is fixed, and, by the Preſſure of its Fibres, forms the Furrow juſt now mentioned. Below theſe we obſerve near the ſemicircular Edges, a great many Riſings and Depreſſions, which with the Inequalities of the temporal Bone form the ſquamous Suture. Near the ſuperior Sides of theſ Bones, towards the poſterior Part, is a ſmal Hole in each, through which a Vein paſſe from the Teguments of the Head to the longitudinal *Sinus*. Sometimes I have ſeen Branch of the temporal Artery paſs thro' thi Hole, to be diſtributed to the ſuperior Part o the *Falx*, and to the *dura Mater* at its Sides where it had frequent Anaſtomoſes, with th Branches of the Arteries derived from the external Carotids, which commonly have th

Name of the Arteries of the *dura Mater*. In everal Sculls one of the *Oſſa Bregmatis* has ot this Hole, and in others there are two Holes to be ſeen. In ſome Subjects this *Foamen* is wanting in both theſe Bones. Moſt requently this Hole is through both Tables; therwhiles the external Table is only perorated. The Knowledge of the Courſe of heſe Veſſels may be of uſe to Surgeons, when hey make any Inciſion near this Part of the Head, leſt if the Veſſels are raſhly cut near the Hole, they ſhrink within the Subſtance of the Bone, and ſo elude both Ligature and Medicines; whence an obſtinate Hæmorrhagy muſt ollow; ſome Inſtances of which I have ſeen.

Internal Surface.

On the internal concave Surface of the parietal Bones we ſee a great many deep Furrows, diſpoſed ſomewhat ike the Branches of Trees: Theſe are formed by the Pulſation of the Arteries of the *dura Mater*, while the Bones are young and ſoft. In ſome Sculls I have obſerved theſe Furrows ſo deep, that the Bone has ſprouted out on each Side till the Sides met, and made a ſort of bony Bridge over the Artery; which, as was obſerved in the general Deſcription of the *Cranium*, ought to make Surgeons cautious in ſawing and raiſing theſe Bones, when they perform the Operation of the Trepan. In theſe furrows we frequently ſee Paſſages into the *Diploe*; and ſometimes I have obſerved Canals going off, which allowed a ſmall Probe to paſs ſome Inches into the bony Subſtance; *Cowper* (a) affirms his having obſerved theſe

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(a) Anatom. Explic. of XC. Tab. Fig. 2.

Canals piercing the Bone towards the *Occiput*: On the ſuperior internal Side of the *Oſſa Bregmatis* there is a pretty large Sinuoſity, frequently larger in the Bone of one Side than of the other, where the ſuperior Part of the *Falx* is faſtned, and the ſuperior longitudinal *Sinus* is lodged. Near the inferior poſterior Angle of theſe Bones internally is a Depreſſion in ſeveral Sublects, formed by Part of the lateral *Sinus*: And then, in no Bones of the Scull are the Pits made by the luxuriant Parts of the Brain more frequently to be ſeen, or more conſiderable than in theſe parietal Bones.

Subſtance. The *Oſſa parietalia* are among the thinneſt Bones of the *Cranium*, but enjoy the general Structure of two Tables and *Diploe* the completeſt, and are the moſt equal and ſmooth.

Connexion. Theſe Bones, at their anterior Edge, are joined to the *Os frontis* by the coronal Suture; at their long inferior Angles, which ſome reckon Proceſſes to the *ſphenoid* Bone, by Part of that Bone's Suture; at their inferior Side, to the *Oſſa temporum*, by the ſquamous Suture and its poſterior *Additamentm*; at their poſterior Side, to the *Os occipitis* or *Oſſa triquetra*, by the lambdoid Suture; at their ſuperior Edge, to one another, by the ſagittal Suture.

Uſes. They have no particular Uſes beſides thoſe mentioned in the Deſcription of their ſeveral Parts, except what are included in the general Structure of the *Cranium*.

Of Children. In a Child born to the full Time none of the Sides of this Bone are

ompleted, and the Hole does not appear.
*OSSA TEMPOKUM**, ſo nam-
d, ſay Authors, from the Hair's
rſt becoming gray on the Tem-
les, and ſo diſcovering Peoples
ges, are each of them equal and ſmooth
bove, with a very thin ſemicircular Edge;
hich, from the Manner of its Connection
ith the neighbouring Bones, is diſtinguiſhed
y the Name of *Os ſquamoſum*. Behind this,
e ſuperior Part of the temporal Bone is
icker and more unequal, and is deſcribed
y *Albinus (a)* as a diſtinct Part, under the
ame of *Pars mammillaris*. Towards the
aſe of the Scull the temporal Bone appears
ery irregular and unequal; and this Part, in-
ead of being broad, and placed perpendicu-
rly, as the others are, is contracted into an
blong very hard Subſtance, extended hori-
ontally forwards and inwards, which in its
rogreſs becomes ſmaller, and is commonly
alled *Os petroſum*.

Oſſa temporum.

Three external Proceſſes riſing
om each of the temporal Bones are
enerally deſcribed. The firſt, plac-
d at the inferior and poſterior Part
f the Bone, from its Reſemblance to a Nip-
e, is called *Maſtoides* or *Mammillaris*. It
not ſolid, but within is compoſed of *Can-
lli* or ſmall Cells, which have a Communi-
ation with the large Cavity of the Ear, the
Drum;

External Surface. Proceſſes.

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* Κροταφῶν, κορσῶν, κοῤῥῶν, λεπιδοειδῆ, πολυειδῆ,
ϑοειδῆ, Temporalia, lapidoſa, mendoſa, dura, arcua-
, tymparum, armalia, ſaxea, parietalia.

(a) De Oſſib. § 26.

Drum; and therefore Sounds being multiplied in this vaulty Labyrinth, will be increaſed before they are applied to the immediate Organ of Hearing. Into the maſtoid Proceſs the *Sterno-maſtoideus* Muſcle is inſerted; and to its poſterior Part, where the Surface is rough, the *Trachelo-maſtoideus* and Part of the *Splenius* are fixed. About an Inch farther forward the ſecond Proceſs begins to riſe out from the Bone; and having its Origin continued obliquely down and forwards for ſome Way, it becomes ſmaller, and is ſtretched forwards to join with the *Os malæ*; they together forming the bony *Jugum*, under which the temporal Muſcle paſſes: Hence this Proceſs has been named *Zygomatic* *. By this Proceſs being produced in this Manner from the temporal Bone the anterior inferior Part of its Baſe is an oblong diſtinct Tubercle, which in a recent Subject is covered with a ſmooth poliſhed Cartilage, that is the ſame continued Subſtance with the Cartilage lining the Cavity immediately behind this Tubercle. From the inferio craggy Part of the *Os temporum* the third Proceſs ſtands out obliquely forwards. The Shape of it is generally ſaid to reſemble the ancient *Stylus ſcriptorius*; and therefore it is called the *Styloid* Proceſs †. Some Authors however contend it ought to be named *Steloid* from its being more like to a Pillar. Severa Muſcles have their Origin from this Proceſs and borrow one half of their Name from it

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* Καγκρὸς, Paris, anſæ oſſium temporum, oſſa arcualia, paria, jugalia, conjugalia.

† Γραφοειδὴς, βελονοειδὴς, πληκτρὸν, Os calaminum ſagittale, clavale, acuale, calcar capitis.

, *Stylo-gloſſus*, *Stylo hyoideus*, *Stylo-pharyn-*
us; and to it the Ligament of the *Os hyoides*
fixed. This Proceſs is often even in Adults
ot entirely oſſified, but is ſeparated at its
oot from the *Os temporum*, and ſometimes
compoſed of two or three diſtinct Pieces.
ound the Root of it, eſpecially at the Fore-
art, there is a remarkable Riſing of the *Os pe-*
oſum, which ſome have eſteemed a Proceſs,
d from the Appearance it makes with the
yliform have named it *Vaginalis*. Others a-
in have, under the Name of *Auditory* Proceſs,
ckoned among the external Proceſſes that
micircular Ridge, which running between
e Root of the *maſtoid* and *zygomatic* Proceſ-
s, forms the Under-part of the *Meatus au-*
torius externus.

The Sinuoſities or Depreſſions on
e external Surface of each *Os tem-* *Cavities.*
rum are theſe: A long *Foſſa* at the
ner and back Part of the Root of the mam-
ary Proceſs, where the poſterior Head of the
gaſtric Muſcle has its Origin. Immediate-
before the Root of the *zygomatic* Proceſs a
cond conſiderable Hollow is left, for lodg-
g the *crotaphite* Muſcle. Between the *zy-*
matic, *auditory* and *vaginal* Proceſſes, a
rge Cavity is formed; through the Middle
which, from Top to Bottom, a Fiſſure is
ſervable, into which the Ligament that ſe-
res the Articulation of the lower Jaw with
is Bone is fixed. The anterior Part of the
avity being lined with the ſame Cartilage
hich covers the Tubercle before it, receives
e *Condyle* of the Jaw; and in the poſterior
art a ſmall Share of the parotid Gland and a

cellular fatty Subſtance are lodged. At the
interior Side of the Root of the *ſtyloid Apophyſe*
a remarkable Cavity is found where the Be-
ginning of the internal jugular Vein, or End o
the lateral *Sinus* is lodged; and round the *Me-*
atus auditorius externus ſeveral Sinuoſities are
formed for receiving the Cartilages and Liga-
ments of the Ear, and for their firmer Adhe-
ſion.

Holes. The proper *Foramina* or Holes tha
commonly appear on the Outſide o
each of theſe Bones are five. *Firſt*
Between the *zygomatic* and *maſtoid* Proceſſe
is a large Funnel-like Canal excavated in th
Bone, which leads to the Organ of Hearing
therefore is called *Meatus auditorius externus* *
The *Second* is the Aqueduct of *Fallopius*, o
Paſſage for the *Portio dura* of the auditor
Nerve, to be ſeen between the *maſtoid* an
ſtyloid Proceſſes. Some way before, and t
the Inſide of the *Apophyſis ſtyloides*, is the *Thir*
Foramen, which runs firſt upwards, then for
wards, and receives into it the internal *ca-*
rotid Artery, and Beginning of the interco
ſtal Nerve; where this Canal is about to mak
the Turn forwards, one or ſometimes tw
very ſmall Holes go off towards the *Tym-*
panum, thro' theſe *Valſalva* (a) affirms the pr
per Artery or Arteries of the *Tympanum* a
ſent. On the anterior Edge of this Bone, ne
the former Hole, a *Fourth* is obſervable, b
ing the Orifice of a Canal, which in a hor
zontal Direction runs outwards and bac
ward

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* Πόρος τῆς ἀκοῆς, ὀπὴ τῶν ὤτων, Feneſtra aurium.

(a) De Aure humana Cap. 2. § 22. & Tab. 7. Fig.

wards, till it terminates in the Cavity of the Ear, called *Tympanum*. This in the recent Subject is continued forward and inward from the Parts which I mentioned juſt now as its Orifice in the Skeleton to the Side of the Noſtrils, being partly cartilaginous and partly ligamentous. The whole Canal is named *Iter à palato ad aurem*, or *Tuba Euſtachiana*. On the external Side of the bony Part of this Canal, and atop of the Chink in the Cavity that receives the *Condyle* of the lower Jaw, is the Courſe of the little Nerve ſaid commonly to be reflected from the lingual Branch of the fifth Pair, till it enters the Tympanum to run acroſs this Cavity, and to have the Name of *Chorda Tympani*. The *Fifth* Hole is very uncertain, appearing ſometimes behind the *maſtoid* Proceſs; otherwhiles it is common to the temporal and occipital Bones; and in ſeveral Sculls there is no ſuch Hole. The Uſe of it, when found, is for the Tranſmiſſion of a Vein from the external Teguments to the lateral *Sinus*: But in ſome Subjects I have ſeen a Branch of the occipital Artery paſs through this Hole, to ſerve the poſterior Part of the *dura Mater*; in others I have ſeen two or three ſuch Holes: But they are oftner wanting than found. And now once for all we may in general remark, That the Magnitude, Number, Situation or Exiſtence of all ſuch Holes, that for the moſt part allow only a Paſſage for external Veins to the internal Receptacles, are very uncertain.

The internal Surface of the *Oſſa temporum* is unequal, the ſuperior circular Edge of the ſquamous Part hav- *Internal Surface.*

ing numerous ſmall Ridges and Furrows fo its Conjunction with the parietal Bones; an the reſt of this Surface of the temporal Bone being imprinted with undulating Depreſſion and Riſings, anſwering to the Convolutions o the middle Part of the Brain, and with Furrows made by the Branches of the Arteries o the *dura Mater.*

Proceſſes. From the under Part of this interna Surface, a large tranſverſe hard craggy Protuberance of this Bone, run horizontally inwards and forwards, with ſharp Edge above, and two flat Sides, one facing obliquely forwards and outwards, and th other as much backwards and inwards. T the Ridge between theſe two Sides, the larg lateral Proceſs of the *dura Mater* is fixed Within this *Os petroſum* the four little Bone and other auditory Parts are contained; th Deſcription of which I ſhall here deſignedly omit, as more proper, in my Opinion, to be demonſtrated with the other Organs of Hearing

Sometimes a ſmall Bone of kin to the Seſamoid, is found between the ſmall Extremit of this *petrous* Proceſs and the *ſphenoid* Bone as is remarked by *Winſlow* (a) after *Riolan.*

Cavities. Towards the poſterior Part of the *Os temporum*, a large deep *Foſſa* i conſpicuous where the *Sinus lateralis* lies, and frequently on the Top of the *petrous* Ridge, a Furrow may be obſerved where a ſmall Sinus is ſituated.

Holes. The internal proper *Foramina* of each of theſe Bones are; *Firſt*, The *Meatu*

audito-

(a) Expoſition Anatomique de corps humain, Traite des Os Secs, § 266.

ditorius internus, in the poſterior plain Side
the *Proceſſus petroſus*. This Hole ſoon di-
des into two, one of which is the Begin-
ng of the *Aquæduct* of *Fallopius*, the other
ds in three or four, *Valſalva (a)* ſays, ſix Ca-
ls, that allow a Paſſage to the Branches of
e *Portio mollis* of the ſeventh Pair of Nerves,
to the *Veſtibulum* and *Cochlea*. Through it
ſo an Artery is ſent, to be diſtributed to the
rgan of Hearing. The ſecond Hole which
on the anterior plain Side of the craggy Pro-
ſs gives Paſſage to a Branch of the lateral Ar-
y of the *Dura Mater*, which joins the *Por-*
dura of the auditory Nerve, while it is in
e *Aquæduct*; for the Diſcovery of this we are
liged to *Fallopius (b)*. Frequently however
Branch of the *Portio dura*, which I ſuppoſe
be the ſame with what *Valſalva (c)* men-
ons, accompanied with a Branch of that Ar-
ry which went into the *Meatus auditorius* a-
ng with the acouſtick Nerve enters into the
ranium, here to be diſtributed to the ſoft Parts
the Side of the *Sella turcica*. Near to this
cond Hole, ſeveral ſmall ones may often be
ſerved, where ſmall Arteries or Twigs of
erves enter; and on the poſterior Surface
ear the auditory *Foramen*, other ſmall Holes,
me pretty remarkable, may be taken notice
f: They ſeem only to convey Veſſels to the
ubſtance of the Bone. The Paſſage of the cu-
neous Vein into the lateral *Sinus*, is ſeen a-
out the middle of the large *Foſſa* for that *Si-*

(*a*) De aure humana, cap. 3. § 11.
(*b*) Obſerv. Anatom.
(*c*) De aure, cap. 3. § 10.

nus; and the Extremity of ſo much of the Canal of the *carotid* Artery, as is formed in this Bone, is evident at the anterior Under-part of the *petrous* Proceſs. Beſides theſe Holes on the external and internal Surface of each *Os temporum*, which are already deſcribed, and are proper to this Bone, there are two other of each Side, which appear both without and within the Scull, and are common to this Bone with the *Os occiptis* and *ſphenoides*, and ſhall afterwards be mentioned in the Deſcription of theſe two Bones.

Subſtance. The ſuperior round Part of the ſquamous Bones is thin, but equal; while the inferior petrous Part is thick and ſtrong, but irregular and unequal, having the Diſtinction of Tables and *Diploe* confounded, with ſeveral Cavities within its Subſtance, which belong to the Organ of Hearing.

Conjunction. The temporal Bones are joined above to the parietal Bones by the ſquamous Sutures, and their poſterior *additamenta*: Before, to the *ſphenoid* Bone by the Suture of that Name; to the *Oſſa malarum* by the *zygomatick* Sutures: Behind, to the *Occipital* Bone by the *Lambdoid* Suture and its *Additamenta.*

Uſes. The Purpoſes which theſe two Bones ſerve, are eaſily collected from the general Uſe of the *Cranium*, and from what has been ſaid in the Deſcription of their ſeveral conſtituent Parts.

Of Infants. In an Infant a ſmall Fiſſure is to be obſerved between the thin ſuperior Part, and the inferior craggy

Part

art of each of theſe Bones, which points out eſe Parts being but lately conjoined; neither *Iaſtoid* nor *Styloid* Proceſſes are yet to be ſeen; ut are afterwards added in the Form of *Epibyſes*: And inſtead of a bony Funnel-like *metus auditorius externus*, there is only a ſmooth ony Ring within which the *Membrana Tymani* is faſtned; at the Entry of the *Tuba* of *Euachius*, the Side of the *Tympanum* is not comleted. A little more externally than the inernal auditory Canal, there is a deep Pit left, ver the ſuperior Part of whoſe Orifice, the iterior ſemicircular Canal of the Ear is ſtrethed. Some Way below which, the poſteior ſemicircular Canal alſo appears maniſtly.

Os Occipitis.

*OS OCCIPITIS**, ſo caled from its Situation, is in the ame Manner as the other Bones f the Scull, convex on the Outſide, and conave internally. Its Figure is an irregular quare or rather *Rhomboid*; the ſuperior Angle f which is generally a little rounded: The wo lateral Angles are more finiſhed but obuſe; and the inferior Angle is ſtretched forvards in Form of a Wedge, and thence is by ome called the *cuneiform* Proceſs. If one would however be very nice in obſerving the everal Turns which the Edges of the *Os Occiitis* make, five or ſeven Sides and as many Angles of this Bone might be deſcribed.

External Surface.

The external Surface is moſtly convex, except at the cuneiform Apophyſe, where it is flatned. At the Baſe

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* Ἴνον, Baſilare, Proræ, Memoriæ, Pixidis, Fibroſum, Nervoſum, Lambde.

of this triangular Proceſs, on each Side of the great Hole, but more advanced forwards than the middle of it, the large oblong Protuberances, named the *Condyles*

Proceſſes. appear, to ſerve for the Articulation of this Bone with the firſt *Vertebra* of the Neck. The ſmooth Surface of each of theſe *Condyloid* Proceſſes, is longeſt from behind forwards, where by their oblique Situation they come much nearer to each other than they are at their poſterior Part. Their interior Sides are lower than the external, by which as *Galen* (a) well remarks they are prevented from ſliding to either Side out of the Cavities of the firſt *Vertebra.* In ſome Subjects each of theſe plain ſmooth Surfaces ſeems to be divided by a ſmall Riſing in its Middle; and the inferior Edge of each Condyle next the great *Foramen*, is diſcontinued about the Middle, by an intervening Notch, which gave *Diemerbroek* (b) Ground to alledge, that each of theſe *Apophyſes* was made up of two Protuberances. Round their Root a ſmall Depreſſion and ſpongy Roughneſs is obſervable, where the Ligaments for ſurrounding and ſecuring the Articulations adhere. Concerning theſe *Condyles* it is to be remarked, that tho' the Motion of the Head is performed on them, yet the Center of Gravity of that Globe does not fall between them, but is a good Way further forward; by which Mechaniſm it is evident, that the Muſcles which pull the Head back, muſt act with a conſiderable Diſadvantage, in reſpect of their

Anta-

(a) De uſu part. lib. 12. cap. 7.
(b) Anat. lib. 9. cap. 6.

ntagoniſts; and that theſe Extenſors muſt be
a conſtant State of Contraction, which is
perior to the natural Contraction of the pro-
er Flexors; elſe the Head would always fall
rwards, as it does when a Man is aſleep, or
bours under a Palſy, as well as in all Infants,
here the Weight of the Head far exceeds the
oportional Strength of theſe Muſcles. This
eeming diſadvantageous Situation of theſe
ondyles is however of good Uſe to us, by
llowing ſufficient Space for the Cavities of the
outh and *Fauces*, and for lodging a ſufficient
umber of Muſcles, which properly ſerve for
ther Uſes, but may at pleaſure be directed to
ct on the Head, and then have as well as the
roper Flexors, an advantageous Lever to act
ith, ſo as to be able to ſuſtain a conſiderable
Veight appended, or other Force applied, to
ull the Head back.

Somewhat more externally than the *Condy-*
id Proceſſes, we remark on the occipital
one a ſmall Riſing and ſemilunated Hollow
f each Side, which make up Part of the *Fora-*
ina common to this Bone with the *oſſa petro-*
; immediately behind which on each Side, a
cabrous bony Ridge is extended from the
iddle of the Condyle towards the Roots of
e *Maſtoid* Proceſs: Into this Ridge the *Muſ-*
ulus lateralis commonly aſcribed to *Fallopius*
inſerted. About the Middle of the external
onvex Surface, a large Arch runs croſs the
one, from the ſuperior lateral Parts of which,
e *Muſculi occipitales* have their Riſe; to the
iddle of it the *Trapezii* are attached; and in-
the inferior Part of it, ſome tendinous Fibres
f the *Complexi* and *Splenii* are fixed. In the

Hollow immediately below the Middle of this Arch, the *Complexi* are inſerted, and in the Depreſſions more external than this, the *Splenii* are inſerted. Below theſe, an oblique Ridge is extended, to which the exterior Fibres of the *recti majores* and of the ſuperior oblique Muſcles are fixed, and the fleſhy Inſertions of theſe Muſcles make Depreſſions below this. Lower ſtill, and nearer the Middle of the Bone, the little hollow Marks of the *recti minores* appear. Through the Middle of the two Arches a ſmall ſharp Ridge runs, which has the Name of *Spine* beſtowed on it by ſome, as indeed Anatomiſts commonly do apply this Name to all the long narrow-edged Protuberances of Bones. This Spine ſerves as ſome Sort of Partition between the Muſcles of different Sides, or rather is owing to the Action of the Muſcles depreſſing the Bone on each Side of it, while this Part is free from their Compreſſion. Theſe Prints of the Muſcles on this Bone are very ſtrong and plain in ſome Subjects, but are not ſo diſtinct in others. All round the great *Foramen* the Edges are unequal, for the firmer Adheſion of the ſtrong circular Ligament, which goes thence to the firſt *Vertebra*. Between the two *Condyles*, are two ſmall Riſings and Depreſſions, where the Ligaments from the Tooth-like Proceſs of the ſecond *Vertebra* of the Neck are fixed: And immediately before theſe, two little Depreſſions are made in the external Surface of the cuneiform Proceſs, for the Inſertion of the *Muſculi recti anteriores minores*, generally, tho unjuſtly alledged to be firſt diſcovered by *Cowper*. And ſtill further forward, nearer the cu-

neiform

iform Bone, are two other ſuch Depreſſions, r the Reception of the *Recti anteriores ma-res.*

On the internal Surface of the *Os cipitis*, we ſee two bony Ridges, ne ſtanding perpendicular, the other nning horizontally acroſs the firſt. *Internal Surface.* The ſuperior perpendicular Leg of this Croſs which the *Falx* is fixed, is hollowed in the Iiddle, or often of one Side, for the Rece-tion of the *Sinus longitudinalis ſuperior*; and e inferior Leg has the ſmall or third Proceſs f the *dura Mater* faſtned to it, and is ſome-mes hollowed by the occipital Sinus. The roſs horizontal Legs have each a Canal form-d in them, that of the Right Side being gene-lly a Continuation of the *Foſſa* in the ſuperior erpendicular Leg of this Croſs: Theſe hori-ontal Canals ſerve to lodge the lateral Sinu-s incloſed in the ſecond or tranſverſe Proceſs f the *dura Mater.* Round this Croſs are four rge Depreſſions; the two ſuperior are formed y the poſterior Lobes of the Brain, and the wo inferior by the *Cerebellum.* Before theſe aſt Cavities, are the Extremities of the *Foſſæ* of e lateral *Sinuſes*. The cuneiform Apophyſe is ternally made hollow for the Reception of e *Medulla oblongata*, and a Furrow remarked y *Albinus* (a), is made on each Side, near the dges of this Proceſs, by a *Sinus* of the *dura Mater*, which empties itſelf into the lateral *Si-us.*

The *Foramina* of this Bone are com-monly five proper, and two common to t, and the *Oſſa temporum.* The firſt of the *Holes.*

(a) De oſſib. § 65.

the proper is the large round one immediately behind the Wedge-like Proceſs. This Hole allows a Paſſage to the *Medulla oblongata*, *Nervi acceſſorii Williſii*, the vertebral Arteries, and ſometimes to the vertebral Veins; *Foramen magnum occipitis* * is the Name this generally obtains. At each Side of this big Hole, near its anterior Part, we always find a Hole, ſometimes two, which ſoon unite again into one that opens externally, immediately above the *Condyloid* Proceſſes; thro theſe the Ninth Pair of Nerves go out of the Scull. The fourth and fifth Holes are theſe, that on each Side pierce from behind the *Condyles* into the *Foſſæ* of the lateral *Sinuſes*; they ſerve for the Paſſage of the cervical Veins to theſe *Sinuſes*: Often one of theſe Holes is wanting, ſometimes both, when the Veins paſs through the great *Foramen*. Beſides theſe five, we frequently meet with other Holes near the Edges of this Bone, for the Tranſmiſſion of Veins; their Number and Diameter is very uncertain, tho' they are ſometimes very large. The two common *Foramina* are theſe large irregular Holes, one on each Side, between the Sides of the *Proceſſus cuneiformis*, and the Edges of the *Oſſa petroſa*. In a recent Subject, a ſtrong Membrane runs croſs from one Side to the other of each of theſe Holes; and in ſome Heads I have ſeen this Membrane oſſified, or a bony Partition dividing each Hole; and in the greater Number of adult Sculls there is a ſmall ſharp-pointed Proceſs ſtands out from the *Os petroſum*, and a more obtuſe Riſing in the occipital Bone bet-

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* Rachitidis, Medullæ ſpinalis.

ween which the Partition is ſtretched. Be-
ind this *Septum*, where the largeſt Space is
ſt, the *Sinus lateralis* has its Paſſage; and be-
ore it the eight Pair of Nerves and *Acceſſorius*
Villiſii make their Exit out of the Scull; and
ome Authors ſay, an Artery paſſes through
is Hole to be beſtowed on the *dura Mater*.

Subſtance.

The *Os Occipitis* is among the
hickeſt Bones of the *Cranium*, tho'
nequally ſo; for it is ſtronger above,
here it has no other Defence than the com-
on Teguments; but below being preſſed by
e Lobes of the Brain and *Cerebellum* on one
ide, and Action of the Muſcles on the other,
is ſo very thin, as to be in many Sculls dia-
anous: But then theſe Muſcles ward off a-
y Injury, and the Ridges and Spines which
e frequent here, make it ſufficiently ſtrong to
ſiſt the ordinary Force of Weapons. All
rough this Bone, the Tables and *Diploe* are
lerably diſtinct, except where it is ſo thin as
become diaphanous.

Connexion.

The occipital Bone is joined a-
ove to the *Oſſa parietalia* and *Tri-*
uetra, by the *Lambdoid* Suture; la-
rally to the *oſſa temporum*, by the *Additamen-*
of the *Lambdoid* Suture; below to the *ſphe-*
id Bone by the Extremity of its own cunei-
rm Proceſs, in the ſame Way that Epiphyſes
d their Bones are joined: For in Children a
gamentous Cartilage is interpoſed between
e occipital and ſphenoid Bones, which gra-
ally turns thinner by each of the Bones ad-
ancing till their Fibres at laſt run into each
her; and about ſixteen or eighteen Years of
ge the Union of theſe two Bones becomes ſo
inti-

intimate, that a Separation cannot be mad
without Violence. The *Os occipitis* is articu
lated below with the firſt *Vertebra* of the Nec
by what I have deſcribed as the third or lon
Species of *Ginglimus*; for each Condyle is re
ceived into a ſuperior oblique Proceſs of tha
Vertebra. What Motion is allowed here, w
ſhall conſider afterwards, where the *Vertebr*
are deſcribed.

Uſes. The Uſes of this Bone are all incl
ded in the Deſcription, therefore nee
leſs to be repeated.

In Children. An Infant born to the full Tim
has this Bone divided by unoſſifi
Cartilages, into four Parts; the fi
of theſe is larger than the other three, is of
triangular Shape, and conſtitutes all the poſ
rior Part of the Bone above the great *Forame*
generally Fiſſures appear in the upper Part a
Sides of this triangular Bone, when all the C
tilage is ſeparated by Maceration; and ſom
times little diſtinct Bones are ſeen towards
Edges of it. The ſecond and third Pieces
this Bone are exactly alike, and ſituated on e
Side of the great *Foramen*, from which, w
near the whole Condyles are produced,
they are extended forwards almoſt to the an
rior Side of the Hole for the ninth Pair
Nerves. The fourth Piece is the cuneifo
Proceſs, which forms a ſmall Share of
great *Foramen*, and of the Condyles; and
twixt it and the *ſphenoid* Bone a Cartilage is
terpoſed.

There are only two Bones of the eight wh
belong to the *Cranium*, now left undeſcrib
viz. the *Ethmoid* and *Sphenoid.* Theſe
alre

ready mentioned, as by moſt Authors eckoned common to the *Cranium* and Face, ecauſe they enter into the Compoſition of oth, as we ſhall ſee they indeed do; but then is a Queſtion, whether by the ſame Parity of eaſon the *frontal Bone* ought not alſo to be eeemed common: But to paſs any idle Diſute about the Propriety of ranging them, let s proceed to examine the Structure of the ones themſelves.

Os Ethmoides.

OS ETHMOIDES[*], or ieve-like Bone, has got its Name from the great Number f ſmall Holes with which that Part of it firſt aken Notice of and deſcribed, is pierced. When this Bone is entire, the Figure of it is ot eaſily deſcribed, but by a Detail of its ſeeral Parts, ſome Idea may be afforded of the whole; and therefore I ſhall diſtinguiſh it into he *Cribriform lamella* with its Proceſs, the *Naal lamella*, *Cellulæ*, and *Oſſa ſpongioſa.*

Cribriform Lamella.

The internal, plain, thin, horiontal *Lamella*, with a middle perendicular Protuberance called *crita galli*[†], from its Reſemblance to a Cock's Comb, is univerſally known. Round his Proceſs, except at the poſterior Part, the *Lamella* is perforated obliquely by a great Numer of ſmall Holes, through which the Filaments of the olfactory Nerves paſs. In a recent Subject, theſe *Foramina* are ſo cloſely lined by the *dura Mater* that they are much leſs

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[*] Cribriforme, *σπογγοειδὴς*, Spongiforme.

[†] Verruca prædura, ſeptum oſſis ſpongioſi.

conſpicuous than in the *Skeleton*. The *Criſta galli* is much thicker and ſtronger than the Baſe it is ſupported by, and ends in a Ridge ſloping backwards and downwards, to which, and the poſterior unperforated Part of the *Lamella*, the Beginning of the *Falx* is connected. Immediately before the higheſt Part of this Proceſs, is the blind Hole of the *Os frontis*, which as we remarked before, is often in a good Meaſure formed by a Notch in the anterior Edge of the *Criſta*.

Naſal Lamella.

From the middle of this *Cribriform Lamella*, a thin ſolid perpendicular Proceſs ſtands out externally, reſting on the ſame common Baſe with the *Criſta galli*; tho' for the moſt Part this external Plate is not entirely perpendicular, but inclined to one Side or other, and therefore divides the Cavity of the Noſe unequally: This *naſal Lamella* is thin at its Riſe, and rather ſtill thinner in its Middle, yet afterwards, at its anterior Extremity, it becomes thicker, that its Conjunction with the Bones and middle Cartilage of the Noſe might be firmer. Hence we may ſee, that if the Bones of the Noſe are broke by a Force applied in a perpendicular Direction to this Plate, the cribriform *Lamella* may be in great Danger, and conſequently the Effects of ſuch a Fracture may prove fatal.

Cellulæ.

At a little Diſtance from each Side of this external Proceſs, a cellular and ſpongy bony Subſtance is conſpicuous. The Number and Figure of the Cells, which are on the ſuperior, poſterior and lateral Part of this irregular Proceſs of each Side, are very uncertain, and not to be repreſented in Vords; only all the Cells communicate with ach other, and with the Cavity of the Noſe; ie ſuperior into which the frontal *Sinuſes* open, re formed like a Funnel. The external poerior Surface of theſe Cells is ſmooth and lain, where this Bone aſſiſts in compoſing the)rbit, at which Place on each Side it has got ie Name of *Os planum*, on the ſuperior Edge f which, a ſmall Notch or two are ſometimes bſerved, which go to the Formation of the *oramina orbitaria interna*, as was remarked n the Deſcription of the *Os frontis*.

Oſſa ſpongioſa.

The ſpongious Bones are on the nferior internal Part of theſe *Cellulæ*; heir Figure is ſomewhat elliptical, nly each terminates in two ſharp Extremities, one of which points obliquely ackwards, and the other forwards. The Exent of theſe Bones is marked on their outſide, vhere they are concave, by a deep Furrow urrounding their Baſe. Their internal Surace next the *Septum naſi* is convex. Theſe wo Proceſſes of the *Ethmoid* Bone, have rom their Subſtance, Figure and Situation ot the Name of *Oſſa ſpongioſa*, or *turbinata uperiora.*

Connexion.

All the Prominencies, Cavities nd *Meanders* of this *ethmoid* Bone, re covered with the Membrane of he Noſtrils, in a recent Subject. The horiontal cribriform *Lamella* of this Bone is lodged in the Diſcontinuation of the *Os frontis*, between its orbitar Proceſſes, to which it is joined by the *ethmoid* Suture, except at the poſterior Part, where it is articulated with the

Cuneiform, by a Suture common to both the Bones, tho' it is generally eſteemed Part of the *Sphenoidal.* Where the *Oſſa plana* are contiguous to the frontal Bone within the Orbit, their Conjunction is reckoned Part of the Tranſverſe Suture. Farther forward than the *Oſſa plana*, the Cells are covered by the *Oſſa unguis*, which are not only contiguous to theſe Cells, but cannot be ſeparated from them, without breaking the bony Subſtance; and therefore in Juſtice, thoſe Bones ought to be demonſtrated as Part of the *Ethmoid* Bone. Below the *Oſſa unguis* and *Plana* theſe Cells and *Oſſa ſpongioſa* are overlop'd by the *Oſſa maxillaria:* And the cellular Part of the *Oſſa palati*, is contiguous to the *Oſſa plana* and Cells backwards. The lower Edge of the Naſal perpendicular *Lamella* is received into a Furrow of the *Vomer* by *Schindyleſis:* Its poſterior Edge is joined to the anterior Part of the *Proceſſus azygos* of the *ſphenoid* Bone. Its ſuperior Extremity joins the *Naſal* Proceſs of the *Os frontis* and *Oſſa naſi*, and its anterior Edges are conjoined to the middle Cartilage of the Noſe.

Uſes. From all which, the Uſes of this Bone are evident, *viz.* to ſuſtain the anterior Lobes of the Brain; to allow the olfactory Nerves a ſafe Paſſage, and the *Falx* a ſure Attachment; to enlarge the Organ of Smelling, or Membrane of the Noſe ſtretched on the Contorſions of this Bone; to ſtraiten the Paſſage of the Air through the Noſe, by leaving only a narrow winding Canal, on the ſenſible membranous Sides of which, all the Subſtances conveyed along with the Air muſt ſtrike ; to form Part of the Orbit of the Eyes and *Septum narium*, while all its Parts are ſo light as not to be uneaſy, or in hazard of ſeparating by their Weight, and ſo thin as to form a large Surface, without occupying much Space ; and at the ſame time this brittle Subſtance is ſufficiently protected from external Injuries, by the firm Bones which cover it. But if once this Bone is ſeized on by any corroding Matter, we may eaſily conceive what Deſtruction may be made : And hence it is, that an *Ozæna* is ſo ill to cure, or that in violent *Scurvies*, or in the *Lues Venerea*, the Fabrick of the Noſe, the Eyes and Life itſelf are in ſo much Danger.

Of Infants. The *Ethmoid* Bone is pretty complete in ripe Children, only the *Criſta galli* and naſal *Lamella* are ſtill cartilaginous, by which this Bone is in ſuch Subjects divided into two.

Os ſphenoides. *OS SPHENOIDES* *, or Wedge-like Bone, ſo called becauſe by its Poſition in the Middle of the Bones of the *Cranium* and Face, it bears, ſay Authors, ſome Analogy to that Inſtrument. It is of a very irregular Figure, nor do I know any Thing to which it may be likened, unleſs perhaps it bear ſome faint Reſemblance to a Bat with its Wings extended.

External Surface. When we view the *Os ſphenoides* externally, five remarkable Proceſſes may be obſerved, which are all of them again ſubdivided. *Proceſſes.* The firſt and ſecond are the two large lateral *Apo-*

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* Cuneiforme, πολύμορφον, multiforme, paxillum, cribratum, palati, colatorii, cavilla, baſilare.

phyſes or Wings; the ſuperior Part of each of which is called the *Temporal Proceſs*, becauſe they join with the temporal Bones in forming the Temples, and Seat for ſome Share of the *crotaphite* Muſcles. That Part of the lateral Proceſſes which jets out towards the Inſide, ſomewhat lower than the temporal *Apophyſes*, and is ſmooth and hollowed, where it makes up Part of the Orbit, is thence named *Orbitar Proceſſes*. Behind the Edge ſeparating theſe two Proceſſes there is often a ſmall Groove, made by a Branch of the ſuperior maxillary Nerve in its Paſſage to the temporal Muſcle. The loweſt and back Part of the Wings, which runs out pretty ſharp to meet the *Oſſa petroſa*, has been ſtiled *Apophyſes ſpinoſæ*: From near the Point of which a ſharp-pointed Proceſs is frequently produced downwards, which ſome call *Styliform*, that affords Origin to the *Ptery-ſtaphylinus externus* Muſcle. From this ſtyloid Proceſs a very ſmall Groove is extended along the Edge of the Bone to the Hollow at the Root of the more internal Plate of the following Proceſſes, which *Winſlow* (a) rightly deſcribes as Part of the *Euſtachian* Tube. The third and fourth external Proceſſes of the *cuneiform* Bone are the two which ſtand out almoſt perpendicular to the Baſe of the Scull, with two Sides and a middle *Foſſa* behind to each of them, and ſhould, to carry on our firſt Compariſon, be likened to the Bat's Legs, but are commonly ſaid to reſemble the Wings of that Creature, and therefore are well known by the Name of *Pterygoid*

(a) Expoſition Anatomique du corps humain traité des Os ſecs, § 233.

'*d* or *Aliform* * Proceſſes. The two Sides of
ch are called *Alæ* or Wings: The external
e broadeſt, and the internal longeſt. From
ch Side of the external *Alæ* the *pterygoid*
uſcles take their Riſe. At the Root of each
ternal Wing a ſmall Hollow may be re-
arked, where the *Muſculus ptery-ſtaphylinus*
ternus riſes, and ſome Share of the cartila-
nous Extremity of the *Tuba Euſtachinana*
ſts; and at the lower Extremity of the ſame
ing is a Hook-like Riſing or Proceſs of the
ne, round which the Tendon of the laſt
med Muſcle plays, as on a Pulley. From
e Edge of the external Wings ſome ſmall
arp Spikes ſtand out; but their Number and
lk are uncertain. The fifth external Pro-
ſs of the *ſphenoid* Bone is that ſharp middle
idge which ſtands out from the Baſe of this
ne: Becauſe it wants a Fellow, it may be
lled *Proceſſus azygos.* The inferior Part of
is Proceſs, where it is received into the *Vo-*
er, is pretty thick, and often not quite per-
ndicular, but inclining more to one Side
an the other. The anterior Part of this Pro-
ſs, where it joins the naſal *Lamella* of the
Ethmoides, is thinner and ſtraighter. Theſe
o Parts have been reckoned two diſtinct
roceſſes by ſome.

The Depreſſions, Sinuoſities and
ſſæ on the external Surface of this *Cavities.*
henoid Bone, may be reckoned up
a great Number; as, two on the temporal
pophyſes, where the *crotaphite* Muſcles lodge;
o on the *orbitar* Proceſſes, to make way for
the

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* Naviculares.

the Globes of the Eyes; two between the temporal and *ſpinous Apophyſes*, for receiving th temporal Bones; two between the Wings o the *pterygoid* Proceſſes, where the *Muſcul pterygoidei interni* and *Ptery-ſtaphylini intern* are placed; two between the *pterygoid* an *orbitar* Proceſſes, for forming the Holes common to this Bone, and to the *Oſſa malarum* and *maxillaria*; two on the inferior Extremities of the *aliform* Proceſſes, which the *Oſſa palati* enter into; two at the Roots of the *temporal* and *pterygoid* Proceſſes, where the largeſt Share of the external *pterygoid* Muſcle have their Riſe; two at the Sides of the *Proceſſus azygos*, for forming Part of the Noſe *&c.*

Internal Surface.

Proceſſes.

On the internal Surface of thi Bone three *Apophyſes*, beſides the temporal and ſpinous Proceſſes, whic are ſeen here too, are commonly deſcribed, *viz.* two at the anterior, an a broad one at the poſterior Part of the Bod of this Bone, which are called *Clinoid*, from their Reſemblance to the Supporters of a Bed The two firſt frequently are joined with th Sides of the laſt, or with the Body of the Bon itſelf, by a bony Croſs-bridge, under whic the *carotid* Arteries paſs. Then the anterio *clinoid* Proceſſes are ſtretched out a good Wa forward and outwards on each Side, to terminate in a very ſharp Point, which have bee eſteemed diſtinct Proceſſes by the Name o *Tranſverſi Spinoſi*; and the poſterior *clinoi* Proceſs has a ſmall Protuberance on eac Side, which hath been reckoned a Proceſs alſo. Between, but a little farther back tha

th

e two anterior *clinoid* Proceſſes, a ſmall
rotuberance riſes from the Bone ſomewhat
Figure reſembling the poſterior *clinoid* Pro-
ſs, but not near ſo large. And often from
e Body of the Bone, between the tranſverſe
roceſſes, another Protuberance forces itſelf
rwards into the *Os Ethmoides*.

Cavities.

Within the Scull there are two Si-
ioſities in the internal Part of each
'ing of the *ſphenoid* Bone, for re-
iving the middle Part of the Brain; one be-
een the tranſverſe ſpinous Proceſſes, for
dging the *Crura medullæ oblongatæ*; and im-
ediately before the third or middle *clinoid*
iſing, a ſingle Pit generally may be remark-
., from which a *Foſſa* goes out on each Side
the *Foramina optica* of this Bone. The Pit
formed for the conjoined optick Nerves;
d in the *Foſſæ* theſe Nerves are lodged, as
ey run divided within the Scull. Between
at third Protuberance and the poſterior *cli-*
id Proceſs, the large Pit for the *Glandula*
uitaria may be remarked. This Cavity, be-
uſe of its Reſemblance to a *Turkiſh* Saddle,
always deſcribed under the Name of *Sella*
ircica or *Ephippium*. On the Sides of the
ſterior *clinoid* Proceſs a *Foſſa* may be re-
arked, that ſtretches upwards, then is con-
ued forwards along the Sides of the *Sella*
ircica near to the anterior *clinoid* Proceſſes,
here a Pit on each Side is made. Theſe
ſſæ point out the Courſe of the two *carotid*
rteries after they have entred the Scull. Be-
es all theſe, ſeveral other *Foſſæ* may be ob-
rved, leading to the ſeveral *Foramina*, and
printed by the Nerves and Blood-veſſels.

The

Holes. The *Foramina* of the *Os ſphenoides* are on each Side, ſix proper, and three common. *Firſt* is the round Hole immediately below the anterior *clinoid* Proceſſes, for the Paſſage of the optic Nerve, and of the Branch of the internal *carotid* Artery that is ſent to the Eye. *Second* is the *Foramen lacerum* or large Slit between the tranſverſe ſpinous and orbitar Proceſſes: The interior Extremity of which Slit is large; and as it is extended outwards, it becomes narrower, and at laſt the external Extremity of it is formed out of the *Os frontis*: Therefore this might be reckoned among the common *Foramina*. Through it the *Motores oculi*, *Pathetici*, and firſt Branch of the fifth, the whole ſixth Pair of Nerves, except one reflected Branch, according to the moſt common Deſcriptions of the Nerves, and an Artery from the internal Carotid, go into the Orbit. Sometimes a ſmall Branch of the external Carotid, deſcribed by *Winſlow* (a), enters near its Extremity, to be diſtributed to the *dura Mater*; and a Vein, ſome call it *Ductus venoſus*, or *Nuck's Aqueduct*, returns to the ſuperior petroſal *Sinus*. *Third* is a round Hole behind the former, allowing a Paſſage to the ſecond Branch of the fifth Pair of Nerves, or ſuperior maxillary Nerves, into the Bottom of the Orbit. To diſtinguiſh this Hole, Authors have, from its Figure, given it the Name of *Foramen rotundum*. *Fourth* is the *Foramen ovale*, about half an Inch behind the round Hole. Through it the third Branch of the fifth Pair of Nerves, or *maxillaris inferior*, goes out; and ſometimes I have ſeen a Vein from the *dura Mater* paſſing out here, as obſerved by *Ingraſſias (a)*. Very near the Point of the ſpinous Proceſs, the *Fifth* Hole of this Bone appears: It is ſmall and round, for a Paſſage to the Artery of the *dura Mater*, which often is accompanied with a Vein. The *Sixth* proper Hole ſeems to be mentioned by *Veſalius (b)*, is obſcurely painted by *Euſtachius (c)*; but is, in my Judgment: firſt fully deſcribed and delineated by *Vidus Vidius (d)*, and has been neglected by Anatomiſts till of late. It is not well to be ſeen, till the cuneiform Bone is ſeparated from all the other Bones of the *Cranium*; for the Beginning of it is hid by a ſmall Protuberance of the internal *Ala pterygoidea*, and by the Extremity of the *Proceſſus petroſus* of the *Os temporum*. It runs above the inner Wing of the *pterygoid* Proceſs, and where it opens into the Cavity of the Noſe, is concealed by the thin laminous Part of the *Os palati*. Through it an Artery from the external *Carotid* runs, to be diſtributed to the Noſtrils: So that as this Hole does not pierce within the *Cranium*, it differs from all the other *Foramina* of this Bone already deſcribed. In ſeveral Subjects, ſoon after the Entry of this Artery, a ſmall Branch goes backwards from it to the *Foſſa pterygoidea*, and

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(a) Expoſition Anatomique de corps humain, traitè des Arteres, § 60. & Dela Tete § 26.

(*a*) Commentar. in Galen. de Oſſib. lib. 1. comment. 8.

(*b*) Anat. lib 1. cap. 12.

(*c*) Tab. 46. fig. 13 & 16.

(*d*) De Anat. lib. 2. cap. 2. Explic. tab. 5. & tab. 5. fig 8, 9, 10. lit. O.

and a ſecond pierces the Scull to ſerve the *dura Mater*. Often in the Middle of the *Sella Turcica* a ſmall Hole or two appear, piercing as far as the cellular Subſtance of the Bone; and ſometimes at the Sides of this *Sella* one or more ſmall Holes penetrate into the *Sinus ſphenoidales*. Theſe Obſervations afforded *Sylvius* (a) and *Laurent* (b) an Argument of ſome Weight in thoſe Days in defence of *Galen* (c), to prove the Deſcent of the *Pituita* that Way into the *Sinuſes* below.

Common Holes.

The *Firſt* of the common Holes is that unequal Fiſſure at the Side of the *Sella Turcica*, between the extreme Point of the *Os petroſum* and the *Proceſſus ſpinoſus* of the cuneiform Bone. Thi Hole only appears after the Bones are boiled for in a recent Subject a conſiderable Part o it is covered by a thin bony Plate that lyes ove the internal carotid Artery, and the anterio Part is filled with a cartilaginous Ligament under which the cartilaginous Part of the *Tub Euſtachiana* is placed: Sometimes however Branch of that Artery which enters the ſixt *Foramen pterygoideum* is ſent through this Subſtance to the *dura Mater*. Here it was the Ancients believed that the *Pituita* drivelled dow from the Emunctory of the Brain, the *Glandula pituitaria*, to the *Fauces*. The *Secon* common Hole is that large Diſcontinuation the external Side of the Orbit, left betwee the orbitar Proceſſes of the cuneiform Bon th the *Os maxillare*, *malæ* and *Palati*. In this large Hole the Fat for lubricating the Globe of the Eye and temporal Muſcle is lodged, and Branches of the Superior maxillary Nerve, with ſmall Arteries from the Carotid and their Veins paſs. The *Third* Hole is formed between the Baſe of this Bone and the Root of the orbitar Proceſs of the Palate-bone of each Side. Through this a Branch of the external carotid Artery, and of the ſecond Branch of the fifth Pair of Nerves, are allowed a Paſſage to the Noſtrils, and a returning Vein accompanies them. Sometimes however this Hole is proper to the Palate-bone, being entirely formed out of its Subſtance.

(a) Calumniæ ſecundæ amolitio.
(b) Hiſt. Anat. lib. 2. quæſt. 11.
(c) De uſu Part. lib 9.

Sinus. Under the *Sella Turcica*, and ſome Way farther forward, but within the Subſtance of the *ſphenoid* Bone, are two *Sinuſes*, ſeparated by a bony Plate, much of kin to thoſe of the *Os frontis*. They open into the ſuperior and poſterior Part of each Noſtril by a round Hole, which is at their upper anterior Part, This Paſſage is not framed by the *Os ſphenoides*, which has an Aperture near as large as any tranſverſe Section of the *Sinus*, but by the *Oſſa palati*, which are applied to the anterior Part of theſe *Sinuſes*, and cloſe them up, that Hole only excepted, which was already mentioned. Frequently the two *Sinuſes* are of unequal Dimenſions, and ſometimes there is only one large Cavity, with an Opening into one Noſtril. *Albinus* (*a*) has deſcribed theſe Cavities, extended ſometimes as far back as the great *Foramen* of the occipital

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(*a*) De Oſſib. § 39.

tal Bone. In other Subjects they are not to be found, when, as *Veſalius (a)* obſerves, the Bone is compoſed of large Cells. The ſame Author alſo deſcribes a Cavity within the Partition of the *Sinuſes*; but this ſeldom is any thing remarkable. Theſe *Sinuſes* are lined with the ſame ſort of Membrane, and ſerve the ſame Uſes as the frontal.

Subſtance. As this Bone is extremely ragged and unequal, ſo its Subſtance is very different, being in ſome Places diaphanous, in others of a middle Thickneſs, and its middle poſterior Part ſurpaſſing the greateſt Share of the *Cranium* in Thickneſs.

Connexion. The *Os ſphenoides* is joined, by its Wings, to the *Oſſa parietalia* above, to the *Os frontis* and *Oſſa malarum* before, to the *Oſſa temporum* behind; by the anterior Part of its Body and ſpinous Proceſſes, to the *Os frontis* and *Ethmoides*; by the poſterior Side of the poſterior *clinoid* Proceſſes, to the *Os occipitis*, where it looks like a Bone with the *Epiphyſes* taken off, and, as was formerly obſerved in the Deſcription of the occipital Bone, it is not to be ſeparated without Violence in Adults; to the *Oſſa palati*, by the Extremities of the *pterygoid* Proceſſes, and ſtill more by the anterior Part of the internal *Alæ*, as alſo by the anterior Part of the *Sinuſes*; to the *Oſſa maxillaria*, by the anterior Part of the external *Alæ*; to the *Vomer* and naſal *Lamella* of the *Os ethmoides*, by the *Proceſſus azygos*. All theſe Conjunctions, except the laſt, which is a *Schindyleſis*, are ſaid to be by means

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(*b*) Lib. I. cap. 6.

means of the Suture proper to this Bone; tho' it is at firſt Sight evident, that ſeveral other Sutures, as the *tranſverſe*, *ethmoidal*, &c. are confounded with it.

We ſee now how this Bone is conjoined to all the Bones of the *Cranium*, and moſt of the upper Jaw; and therefore obtained the Name of the *Wedge-like Bone*.

Uſes.

The Uſes and Deſcription are ſo blended, as to leave nothing new to add to thoſe which may be collected eaſily from the foregoing Account.

In Children.

The *ſphenoid* Bone is near complete in a *Fœtus* of nine Months, only the great *Alæ* do after Maceration ſeparate from the Body of the Bone; the *Proceſſus azygos* is very large and hollow; the internal Surface of the Body is unequal and porous, and the *Sinuſes* do not appear.

Having thus finiſhed the Deſcription of the *Cranium*, we now proceed to that of the Face.

The FACE.

Divided.

The *FACE* is the irregular Pile of Bones at the anterior and inferior Part of the Head, divided by Authors into two *Maxillæ* or Jaws, Upper and Lower.

SUPERIOR MAXILLA.

The *Superior Maxilla* * is the common Deſignation given to the upper immoveable Share of the Face; tho', if we would follow *Celſus* (*a*), we ſhould apply the Word *Maxilla* to the lower Jaw only, and uſe the Name *Mala* for this upper Jaw. However, in Com-

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* Σιαγὼν, γένος, Mandibula.

(*a*) Lib. 8. cap. 1.

plaiſance to prevailing Cuſtom, I ſhall follow the common Terms now employed. The Shape of the ſuperior *Maxilla* cannot eaſily be expreſſed; nor is it neceſſary, provided the Shape and Situation of all the Bones which compoſe it are deſcribed. It is bounded above by the tranſverſe Suture, behind by the anterior Edges of the *ſphenoid* Bone, and below by the Mouth.

Conſiſts of 13 Bones. It conſiſts of ſix Bones on each Side, and a thirteenth *impar* middle Bone, beſides the Teeth. The Names of them are, *Oſſa naſi*, *oſſa unguis*, *oſſa malarum*, *oſſa maxillaria*, *oſſa palati*, *oſſa ſpongioſa inferiora*, and *Vomer*.

The *Oſſa naſi* are placed at the ſuperior Part of the Noſe; the *Oſſa unguis* at the internal *Canthi* of the Orbits: *Oſſa malarum* form the Prominence of the Cheeks; *Oſſa maxillaria*, the Side of the Noſe, with the whole inferior anterior Part of the upper Jaw, and the greateſt Share of the Roof of the Mouth: *Oſſa palati* are ſituated at the poſterior Part of the Palate, *Nares* and Orbit: *Oſſa ſpongioſa* are ſeen in the lower Part of the *Nares*: And the *Vomer* helps to ſeparate theſe two Cavities.

Connected. Theſe Bones of the upper Jaw are all, except the *Vomer*, and perhaps the *Oſſa ſpongioſa*, joined to the Bones of the *Cranium*, and to each other by Sutures; the Indentations of which are not very conſpicuous externally, but plainly appear when the Bones are taken aſunder, tho' not near ſo large as thoſe of the Scull, where there is much more Neceſſity for Security againſt both external Injuries and an extruding Force from within. Often in aged Sculls the Sutures of the upper Jaw are deſtroyed, for the Bones grow together; which can be of little prejudice, ſince the greateſt Uſe of any Separation here ſeems to be no more, than to allow the Bones to be duly extended. Authors have generally diſtinguiſhed theſe Sutures by Numbers; but I would rather chuſe, with *Vander Linden*, *(a)*, and ſome few other Writers, to aſſign particular Names to them; which might, if it was neceſſary, be eaſily contrived from their Situation, or the Bones they connect. One muſt at firſt View ſee, from the Manner of the Conjunction of theſe Bones, that they can have no Motion, except in common with the *Cranium*.

The Purpoſes which this Pile of Bones ſerves, will ſufficently appear in the particular Deſcriptions which ſhall be given of each, in the ſame Order in which they were already ranged.

Oſſa naſi.

OSSA NASI, ſo named from their Situation at the Root of the Noſe, are each of an irregular oblong ſquare Figure, being broadeſt at their loweſt Extremity, narroweſt a little higher than their Middle, and becoming ſomewhat larger at the Top, where they are ragged and thickeſt, and have a Curvature forwards, that their Connexion with the *Os frontis* might be ſtronger.

Sides.

The inferior Edge is unequal, and towards the poſterior Part is ſtretched out, where the Cartilages of the Noſtrils

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(a) Medicin. phyſiolog. cap. 13. art. 2. § 10.

ſtrils are connected, that they might be united more firmly. At the interior Part of the anterior Side, they are pretty thick, eſpecially above, and unequal, that their Conjunction to each other might be ſtronger; and a ſmall Riſing may be there remarked, where they are ſuſtained by the *Septum narium.* Their poſterior Side, at its ſuperior half, has externally a Depreſſion, where it is overloped ſome way by the *Oſſa maxillaria*; and the lower half covers theſe ſame Bones: By which Contrivance they neither will eaſily yield to a Preſſure applied to their Fore-part or Sides. The Bodies of the *Oſſa naſi* are a little convex externally, and concave internally, that they might more ſtrongly reſiſt any Violence offered and might enlarge the Cavities of the Noſe. A ſmall Hole is frequently to be obſerved on their external Surface, into which, two, three or four Holes, which appear internally, terminate, for the Tranſmiſſion of ſmall Veins.

Subſtance. The *naſal Bones* are firm and ſolid, with very few *Cellulæ* or *Cancelli* to be obſerved in them, the thin Subſtance of which they conſiſt, not requiring any great Quantity of Marrow.

Joined. They are joined above to the *Os frontis*, by the Middle of the tranſverſe ſuture; behind, to the *Oſſa maxillaria*, by a ſmall *Harmonia* or Suture of each Side, which might be called *Naſalis lateralis**; below, to the Cartilages of the Noſe; before, to one another by a Suture, which may be named *Naſalis anterior* [†]; internally, to the *Septum narium.*

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* Naſalis obliqua.

These Bones ſerve to cover and defend the Root of the Noſe. *Uſes.*

The *naſal Bones* are in an Infant proportionally ſhorter and leſs thick at their upper Part, than in an Adult, but are otherwiſe complete. *Of Infants.*

OSSA UNGUIS or *LACRYMALIA:* Theſe Names have been given theſe two Bones, becauſe their Figure and Magnitude is ſomething near that of a Nail of one's Finger, and becauſe the Tears paſs upon them into the Noſe. *Oſſa Unguis.*

Their external Part is compoſed of two hollow ſmooth Surfaces and a middle Ridge. The poſterior Cavity forms a ſmall Share of the Orbit for the Eye-ball to move on, and the anterior is a deep perpendicular Canal or *foſſa* larger above than below, containing the lacrymal *Sac* and *Duct*. This *Foſſa* of the Bone appears ſomewhat cribriform, or has a great Number of ſmall Holes through it, that the Filaments from the Membrane which lines it, inſinuating themſelves into theſe Holes, might prevent a Separation of the Membrane, and ſecure the Bone in its natural Situation: The Ridge between theſe two Cavities of the *Os unguis* is the proper Boundary at this Place of the Orbit. The internal or poſterior Surface of this Bone conſiſts of a Furrow in the middle of two Convexities. *External Surface.* *Ductus lacrymalis.*

The

[†] Naſalis, naſalis recta.

Subſtance. The Subſtance of the *Os unguis* is as thin as Paper, and very brittle, which is the Reaſon that thoſe Bones are ſo often wanting in Skeletons.

Connexion. Each of theſe Bones is joined, above, to the *Os frontis*; behind, to the *Os planum* of the *Ethmoid* Bone, by Part of the tranſverſe Suture; before, and below, to the *Os maxillare*, by a ſmall ſemicircular Suture, which the Name of *lacrymalis* would not be improper to: And internally, the *Oſſa unguis* cover ſome of the *Sinus ethmoidales*; nay, are really continuous with the bony *Lamellæ*, which make up the Sides of theſe Cells; ſo that they are as much Part of the *Ethmoid* Bone as the *Oſſa plana*.

Uſes. Theſe unguiform Bones compoſe the anterior internal Parts of the Orbits, lodge the lacrymal Sac and Duct, and cover the *Cellulæ ethmoideæ*. From which Situation and tender Subſtance of theſe Bones, we ſee how eaſily a raſh Operator may deſtroy a conſiderable Share of the Organ of Smelling, in performing the Operation of the *Fiſtula lacrymalis*; but that thoſe Bones, when hurt, will with no great Difficulty caſt off, and conſequently the Wound be ſoon cured, unleſs the Patient labours under a general *Cacoethes*, or there is a Prediſpoſition in the Bones to a *Caries*; in which Caſe, a large Train of bad Symptoms follows, or at beſt, the Cure proves tedious.

In a Child. Theſe Bones are fully formed in a Child.

Oſſa malarum.

OSSA MALARUM * was the Name given by *Celſus*, as was aleady remarked, to all the upper aw, but is now appropriated to he irregular ſquare prominent Bones, which on each Side form the Cheeks. Their anteior Surface is convex and ſmooth, the poſteior is unequal and concave, for lodging Part f the *Crotaphyte* Muſcles.

Proceſſes.

The four Angles of each of theſe Bones have been by ſome reckoned Proceſſes. The poſterior ſuperior one, which is the longeſt and thickeſt, is caled the *ſuperior orbitar* Proceſs. The ſecond, r anterior ſuperior, which terminates very harp, with the two Sides near equally comining to form the Angle, is named the *infeior orbitar* Proceſs. The ſhorteſt and neareſt o a right Angle, which is the anterior infeior, is called *Maxillary*. The fourth or poterior inferior Extremity, is pointed with one ide ſtraight, the other ſloping, and is termed *Zygomatic*. Between the two orbitar Angles, he concave Arch of a Circle, which makes bout a Third of the external Circumference f the Orbit, may be obſerved, from which fifth Proceſs is extended backwards withn the Orbit, to form near one Third of that Cavity; hence may be called the internal *orbiar* Proceſs: About the middle of this, we may remark a conſiderable Notch, which orms Part of the great Slit at the Outſide of he Orbit. From the lower Edge of the *Oſſa alarum*, between the maxillary and zygomatick Proceſſes, the *Maſſeter* Muſcle takes its Origin; and from the exterior Surface of the *Zygomatic* Proceſs the *Muſculus diſtortor oris* riſes; in both which Places a Roughneſs may be remarked on the Surface of the Bone.

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* Jugalia vel Zygomatica, hypopia, ſubocularia.

Holes. On the external Surface of the Cheek-bones, one or more ſmall Holes are commonly found, for the Tranſmiſſion of ſmall Nerves or Blood-veſſels from, and ſometimes into the Orbit; and on the internal Surface, the Holes for the Paſſage of the nutritious Veſſels of theſe Bones is very conſpicuous. The great Slit at the Outſide of the Orbit, may be conſidered as a Hole common to this Bone, the Sphenoid, Maxillary and Palate Bones.

Subſtance. The Subſtance of theſe Bones is thick for their Bulk, hard and pretty ſolid with ſome *Cancelli*.

Connexion. The *Oſſa malarum* are joined, by their ſuperior and their internal orbitar Proceſſes to the *Os frontis*, and orbitar Proceſs of the *ſphenoid* Bone, by means of the tranſverſe Suture: By their Edge between the internal and inferior orbitar Proceſſes, to the *Oſſa maxillaria*, by means of what may be termed the *internal orbitar* Suture: By their Sides, between the maxillary and inferior orbitar Proceſſes, again to the maxillary Bones, by a Suture that may be ſtiled *external orbitar*; and by the zygomatick Proceſs to the *Oſſa temporum*, by means of the *ſutura zygomatica*.

Of Infants. The Cheek-bones are entire and fully oſſified in all their Parts in Infants.

Oſſa maxillaria.

OSSA MAXILLARIA SUPE-
IORA are the largeſt Bones, and
onſtitute the far greater Part of the
pper Jaw, which has appropriated
e Name of *Maxillaria* to them. Their Fi-
ure either conjunctly or ſeparately, is ſo irre-
ular, that Words can ſcarce give an Idea of

Proceſſes.

The *Apophyſes* of each *Os maxillare*
ay be reckoned ſix. *Firſt*, The
ng Proceſs which riſes from its ſu-
rior and anterior Part, turns ſtill ſmaller, as
runs upwards to make the Side of the Noſe,
d from its Situation, one may name it *Naſa-*
. At the Root of this a tranſverſe Ridge
ay be obſerved within the Noſtrils, which
pports the anterior ſuperior Edge of the *Os*
ongioſum inferius. The *Second* is produced
ckwards and outwards from the Root of the
aſal Proceſs, and may be called *orbitar*, be-
uſe it forms the lower Side of that Cavity.
rom this proper orbitar Part irregular Riſings
e extended outwards where this maxillary
one is to be joined to the Cheek-bone. The
dge of this orbitar Proceſs, with the Ridge of
e naſal which is continued from it, conſti-
te a conſiderable Portion of the external Cir-
mference of the Orbit. Behind the orbitar
oceſs, a large Tuberoſity, or Bulge of the
one appears, which is eſteemed the third Pro-
ſs. On the internal Part of this we often
eet with a Ridge, almoſt of the ſame Height
ith that in the naſal Proceſs, which runs
anſverſely, and is covered by a ſimilar Ridge
the *Os palati*, on which the poſterior ſuperi-
Edge of the *Os ſpongioſum inferius* reſts; the
convex

convex poſterior Part of this Tuberoſity is rough, as *Albinus (a)* has remarked, for the Origin of Part of the external *Pterygoid* Muſcle, and more internally is ſcabrous, where the Palate and ſphenoid Bones are joined to it. That ſpongy Protuberance, named *Phatnia* by the *Greeks*, at the lower Circumference of this Bone, where the Sockets for the Teeth are formed, is reckoned the *Fourth*. The *Fifth* is all that horizontal Plate, which forms the greater Part of the Baſe of the Noſtrils and Roof of the Mouth: Its upper Surface, which belongs to the Noſtrils, is very ſmooth, but the other below is arched and rough, for the ſtronger Adheſion of the Membrane of the Mouth, that is ſtretched upon it, and in chewing, ſpeaking, *&c.* is more liable to be ſeparated. The *Sixth* riſes like a Spine from the inner Edge of the laſt, and by this Means forms a ſmall Part of the *Septum narium*.

Cavities. The Depreſſions in each *Os maxillare* are, 1. A Sinuoſity behind the orbitar Proceſs, made by the *temporal* Muſcle. 2. Immediately before the ſame Proceſs, a Pit where the Origin of the *Muſculus elevator labiorum communis*, and *Elevator labii ſuperioris*, with a Branch of the fifth Pair of Nerves, are lodged ſecurely. 3. The hollow Arch of the Palate. 4. The ſemicircular great Notch, or Entry to the inferior Part of the Noſtrils, betwixt the Root of the naſal Proceſs and Spine of the palatine *Lamella*. Below this, the Fore-part of the Bone is flattened, ſometimes hollowed by the *Muſculus depreſſor*

(*a*) De Oſſib. § 79.

preſſor labii ſuperioris. 5. Sockets for the Teeth, by the *Greeks* called *Bothnia* *. Their Number is uncertain, being ſometimes more, ſometimes fewer, according to the Number of Roots the Teeth have. 6. The *Lacrymal foſſa* in the *naſal Proceſs*, which aſſiſts the *Os unguis* to form a Paſſage for the *Ductus lacrymalis*; immediately without which, *Winſlow* (a) remarks a ſmall Depreſſion, from which the inferior or leſſer oblique Muſcle of the Eye has its Origin. 7. The Channel on the upper Part of the great Tuberoſity within the Orbit, which is almoſt a complete Hole; in this a Branch of the ſuperior maxillary Nerve paſſes. Beſides theſe, the ſuperior Surface of the great Bulge is concave, to receive the under Part of the Eye, and immediately above the tranſverſe Ridge in the naſal Proceſs, a ſmall Hollow is formed by the *Os ſpongioſum*. In ſome Subjects, the naſal Proceſs has a ſmall round Pit above the lacrymal Duct, where the ſmall Tendon of the orbicular Muſcle of the Eye-lids is inſerted. It is this Tendon, and not the Tendon of the larger oblique Muſcle of the Eye, which there is a Probability of cutting in the Operation of the *Fiſtula lacrymalis*.

Foramina.

The *Foramina* of this Bone are two proper, and two common, which are always to be found, beſides ſeveral others, whoſe Magnitude, Number, *&c.* are uncertain. Firſt of the proper is the *Orbiter externus*, immediately below the Orbit, by which the infra-orbitar Branch of the ſecond

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* Βόθρια, ὁλμίσκοι, Alveoli, Foſſulæ, mortariola, Fræna, Locelli, Caveæ, Præſepiola, Loculamenta.

(a) Expoſition Anatomique des Os Secs, § 276.

Branch of the fifth Pair of Nerves, and a ſmall Artery come out, after having paſſed in the Channel, at the Bottom of the Orbit, deſcribed *Numb.* 7. of the Depreſſions. This Hole is often double, and that when the Nerve has happened to ſplit before it has eſcaped from the Bone. The *Foramen inciſivum*, juſt behind the Fore-teeth, is the other proper Hole; which at its under Part, is one irregular Hole common to the *Oſſa maxillaria*, when they are joined, but as it aſcends, ſoon divides into two, three, or ſometimes more Holes, ſome of which open into each Noſtril. Through them ſmall Arteries and Veins, and a Twig of the ſecond Branch of the fifth Pair of Nerves paſs, and make a Communication between, or join the lining Coats of the Noſe and Mouth. In ſome Subjects, *Steno*'s Duct may be traced ſome Way on the Side of theſe Paſſages next the Noſe, and ſmall Orifices may be obſerved opening into the Mouth. The firſt common Hole is that which appears at the internal poſterior Part of the *Tuberoſity* and *Alveoli* of the Teeth, and is formed by a *Foſſa* in this Bone, and a correſponding one in the *Os palati:* Through it the palatine Nerve, which is a Branch of the ſecond Branch of the fifth Pair of Nerves runs to the Palate. The other common Hole is the great Slit in the Outſide of the Orbit deſcribed already, as the ſecond common Hole of the ſphenoid Bone.

On the naſal Proceſs, often Holes may be obſerved for the Paſſage of Veſſels to the Subſtance of the Bones, and at the back Part of the Tuberoſity, ſeveral *Foramina* are placed for the Tranſmiſſion of Nerves to the Cavity within: But theſe are uncertain.

All the Body of the *Os maxillare* is hollow, and leaves a large *Sinus*, of kin to thoſe of the *Os frontis* and *Sphenoides*, which is commonly, but unjuſtly, called *Antrum Highmorianum* *, ſince it is ſcarce ever omitted by Anatomiſts, before *Highmore* (a) was ſo particular about it. *Veſalius* ſeems to have a pretty good Title to the Honour of the Diſcovery of *theſe Cavities*, as alſo of the the *frontal* and *ſphenoidal* Sinuſes; at leaſt ſo thought *Fallopius* (b). When the *Os maxillare* is ſingle or ſeparated from all the other Bones of a Skeleton, its *Antrum* appears to have a large Aperture into the Noſtrils; but, in a recent Subject, it is ſo covered at its poſterior Part, by the *Os palati*; in the Middle, by the *Os ſpongioſum inferius*; before, by a ſtrong Membrane, that one, or ſometimes two ſmall *Foramina* are only left at the the ſuperior Part, which after a ſmall winding Progreſs, ſcarce bigger than a Crow-quill, open into the *Nares*, between the two *Oſſa ſpongioſa*: At the Bottom of this Cavity, we may often obſerve with *Highmore* (c), ſome Protuberances, in which the ſmall Points of the Roots of the Teeth are contained. The maxillary *Sinuſes* have the ſame Uſes as the *frontal*; and we may remark with *Fallopius* (d), that theſe Cavities are wanting in Children, as well as the others juſt now mentioned, when the

Sinus.

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* Genæ.

(a) Diſquiſ. Anat. lib. 3. part. 2. cap. 1.

(b) Expoſit. de Oſſibus, cap. 13, 15.

(c) Diſquiſ. Anat. lib. 3. part. 2. cap. 1.

(d) Obſerv. Anat.

the Bones are only cellular in thoſe Places, where the *Sinuſes* afterwards appear. Between this Cavern and Sockets of the Teeth, often an exceeding thin bony Plate is interpoſed, which may ſoon be eroded by any acrid Matter collected in the *Antrum*, of which *Highmore (a)* gives a remarkable Inſtance, which naturally leads us on Diſcovery of the Symptoms of ſuch a Collection, to *Cowper*'s *(b)* Practice of pulling the Teeth, and piercing the *Septum* between the Socket and *Antrum*, in order to procure Evacuation of the collected Matter. The good Succeſs of which Practice we have confirmed to us in ſeveral Hiſtories related by the Propoſer of it, and by others.

Subſtance. The Subſtance of the *Oſſa maxillaria* is all compact, except the inferior Proceſs, where the Teeth are lodged, which is very ſpongy.

Joined. The *maxillary* Bones are joined above by the Extremity of their naſal Proceſſes to the *Os frontis*, by Means of the tranſverſe Suture; at the Sides of theſe Proceſſes, to the *Oſſa unguis*, by the *lacrymal* Sutures; and to the *Oſſa naſi*, by the *lateral naſal* Sutures; by their orbitar Proceſſes, to the *Oſſa malarum*, by Means of the *external orbitar* Sutures; by the internal Sides of the Tuberoſities, to the *Oſſa plana*, by Part of the *ethmoidal* Suture; by the back Part of the Tuberoſities, to the *Oſſa palati*, by the *Harmoniæ* or faint *Suturæ palato-maxillares*; by the poſterior Edges of their palatine *Lamellæ*, to the *Oſſa palati*;

(*a*) Diſquiſ. Anat. lib. 3. part. 2. cap. 1.
(*b*) Drake's Anthtopolog. nov. Book 3. chap. 10.

palati by Means of the *Sutura palatina tranſverſalis* *; by their naſal *Spines*, to the *Vomer*, by a very ſlight Suture, which might be called *Spinoſa*, or rather a double *Schindyleſis*; by their Sockets, to the Teeth by *Gomphoſis*; by the internal Edge of the Palate-*Lamella*, to one another by a Suture, which might be named *Palatina longitudinalis* †; on the upper and Fore-part of which, a Furrow is left for receiving the Cartilage which forms the Partition of the Noſtrils; and between the Fore-part of the Noſtrils and Mouth to each other by a Suture, which may be named *Mentalis*; and ſometimes they are connected to the *Oſſa ſpongioſa inferiora*, by a plain Concretion or Union of Subſtance.

Thus we ſee theſe two Bones form the greater Part of the Noſe and Roof of the Mouth, and a conſiderable Share too of the Orbit. They contain ſixteen Teeth, give Riſe to Muſcles, Tranſmiſſion to Nerves, &c. as above. *Uſes.*

Each of the *Oſſa maxillaria*, is pretty complete in a new born Child, only the external orbitar Proceſs, inſtead of being ſcabrous, is hollow with remarkable *Foramina* in it; there ſeem to be only five Sockets for the Teeth, of which he two poſterior are very large. The Palate *Lamella* is cribriform about the Middle. The great Tuberoſity is not formed; and in place of the *Antrum*, there is only an oblong Cavity at the Side of the Noſtrils. *Of Children.*

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* Arcuata, Palatina tranſverſa poſtica.

† Laquearis, Palataria recta.

Oſſa palati. *OSSA PALATI* are commonly deſcribed as two ſmall ſquare Bones, at the poſterior Part of the Palate or Roof of the Mouth, tho' they are of much greater Extent, being continued up the poſterior Part of the *Nares* to the Orbit, as *Euſtachius* (*a*) has obſcurely painted, *Vidus Vidius* has hinted (*b*) and delineated (*c*), and *Winſlow* (*d*) has fully demonſtrated. Each Palate-bone may there-*Divided.* fore be divided into four Parts, the Palate-ſquare-bone, the Pterygoid Proceſs, naſal *Lamella*, and orbitar Proceſs.

The Square-bone is unequally *Square-bone.* concave, for enlarging both the Mouth and Cavity of the Noſe. The ſuperior Part of its internal Edge riſes into a Spine, after the ſame Manner as the Palate-*Lamella* of the *Os maxillare*, to be joined with the *Vomer*. Its anterior Edge is unequally ragged, for its firmer Conjunction with the Palate Proceſs of the former Bone. The internal Edge is thicker than the reſt, and full of unequal prominent Teeth, for its Conjunction with its Fellow of the other Side. And the poſterior Side is ſomewhat in form of a Creſcent, and thick for the firmer Connexion of the *Velum pendulum palati*, the internal Point being produced backwards, to afford Origin to the *Muſculus Palato-ſtaphylinus* of *Dionis* and *Douglas*. This Square-bone is well diſtinguiſhed from the *Pterygoid* Proceſs by a per-

pendi-

(*a*) Tab. 47. Fig. 1. 3. 6. 7. 8.

(*b*) De Anat. lib. 2. cap. 2. explicat. Tab. 6.

(*c*) Tab. 6. Fig. 19.

(*d*) Memoires de l'Acad. des Sciences 1720.

endicular *Foſſa*, which applied to ſuch anoner in the *Os maxillare*, forms a Paſſage for he Palatine-branch of the fifth Pair of Nerves; and by another ſmall Hole behind this, through which a Twig of the ſame Nerve paſſes.

Pterygoid Proceſs.

The *Pterygoid* Proceſs is ſomewhat riangular, having a broad Baſe, and nding ſmaller above. The poſterior Side of this Proceſs has three *Foſſæ* formed in it; the two lateral receive the Extremities of the two Plates of the ſphenoid Bone hat are commonly compared to a Bat's Wing; he middle *Foſſa* makes up Part of what is commonly called the *Foſſa pterygoidea*; the anterior Side of this palatine ptergoid Proceſs, is an irregular Concave, where it receives the Back-part of the *Tuberoſitas maxillaris.* Frequently ſeveral ſmall Holes may be obſerved in this triangular Proceſs, particularly one near the Middle of its Baſe, which a little above communicates with the common and proper Holes of this Bone already taken Notice of.

Naſal Lamella.

The *naſal Lamella* is extremely thin and brittle, and riſes upwards from the ſuperior Side of the exterior Edge of the Square-bone, and from the narrow Extremity of the *Pterygoid* Proceſs; where it is ſo weak, and at the ſame time, ſo firmly fixed to the *Os maxillare*, as to be very liable to be broke in ſeparating the Bones; and therefore it is, that Authors have failed in their Deſcriptions of this Bone. From the Part where this *Lamella* riſes, it runs up pretty broad on the internal Side of the *Tuberoſitas maxillaris*, to form a conſiderable Share of the Sides of the *Antrum Highmorianum*, and to cloſe up the Space between the *ſphenoid* and the great Bulge of the Maxillary Bone, where there would otherwiſe be a large Slit opening into the Noſtrils, as *Albinus (a)* has well remarked. From the middle internal Side of this thin Plate, a croſs Ridge placed on ſuch another of the maxillary Bone is extended; on it, the back Part of the *Os ſpongioſum inferius* reſts; along the outſide of this Plate, the perpendicular *Foſſa* made by the Palate Nerve is obſervable.

Orbitar Proceſſes.

At the ſuperior Part of this naſal *Lamella*, the Palate Bone divides into two Proceſſes, which I already named *orbitar*, between which and the Body of the *ſphenoid* Bone, that Hole is formed, which I mentioned as the laſt of the Holes common to the *ſphenoid* Bone. Sometimes this Hole is wholly formed in the *Os palati*, by a bony croſs Plate going from the one orbitar Proceſs to the other. A Nerve, Artery and Vein belonging to the Noſtrils paſs here. The largeſt of the two orbitar Proceſſes is the anterior; the anterior Surface of which is contiguous to the back Part of the *Sinus maxillaris*, and its ſuperior Surface appears in the Bottom of the Orbit, behind the poſterior Part of the *Os maxillare* and below the *Os planum*. Its poſterior Surface is cellular, reſembling much the Appearance of the *Cellulæ Ethmoideæ*, to which it is contiguous; it is placed on the Aperture of the *Sinus ſphenoidalis*, ſo as to leave only a round Hole

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(a) De Oſſib. § 88.

ole at its ſuperior anterior Part. The other art of the orbitar Proceſs is joined to the in- rnal Side of the ſuperior poſterior Part of the *uberoſitas maxillaris.*

Subſtance. The Palate ſquare Part of this Pa- te Bone and its pterygoid Proceſs e pretty firm and ſtrong with ome *Cancelli*; but the naſal Plate and orbitar roceſſes are very thin and brittle.

Connexion. The *Oſſa palati* are joined to the *ſſa maxillaria*, by the anterior Edge the Palate Square-bone, by eans of the *Sutura palatina tranſverſalis*: y their thin naſal *Lamellæ*, and Part of their bitar Proceſſes to the ſame Bone, by the *Pa- to-maxillares* Sutures: By their *Pterygoid* roceſſes, to the *Alæ veſpertilionum*, by the *henoid* Suture: By the tranſverſe Ridges of e naſal *Lamellæ*, to the *Oſſa ſpongioſa inferi- a* by Contact; hence frequently in old Sculls intimate Union of Subſtance is found: By e orbitar Proceſſes, to the *Oſſa plana* and *Cel- læ ethmoideæ*, by the *Ethmoid* Suture: To e Body of the *ſphenoid* Bone, by the *ſphenoid* uture: And by the internal Edge of the quare-bones to one another, by the *Palatina gitudinalis* Suture.

Uſes. The Palate-bones form Part of the late, *Nares*, Orbits and *Foſſæ ptery- ideæ*, and cover Part of the *Sinus ma- llares*, *ſphenoidales* and *ethmoidei.*

In Children. Theſe Bones are very complete a new born Infant, the naſal *amella* being thicker and ſtronger an in Adults; but the orbitar Proceſs has ot the Cells which appear in old Bones.

When

Diſeaſes. When we are once acquainted with the Hiſtory of theſe Bones, the Reaſon is evident why the Eyes are ſo much affected in Ulcers of the Palate, as to be often attended with Blindneſs, which frequently happens in an ill managed *Lues Venerea*; or why on the other hand the Palate ſometimes ſuffers from an *Ægylops*, as in the Inſtance related by *Hoffman* (a).

Oſſa turbinata inferiora. *OSSA TURBINATA*, or *ſpongioſa inferiora*, are ſo called from their pyramidal Figure, ſpongy Texture, without any external ſmooth firm *Lamella*, and from their Situation at the inferior Part of the Noſtrils, towards the Cavity of which they are convex, while on the other Side, which faces the *Antrum maxillare*, they are concave. From their ſuperior ſtraight Edge, contiguous to the *Oſſa maxillaria*, two ſmall Proceſſes ſtand out: The poſterior, which is like a Hook, covers ſome of the *Antrum Highmorianum*; the anterior joins with the *Os unguis*, to make up Part of the *Ductus lacrymalis*. The inferior Edge is a convex Curve, the Middle of which is pendulous, without a Connexion to any Bones; but the poſterior Part, which ends in a very acute Angle with the ſuperior Edge, is ſupported by the tranſverſe Ridge of the naſal *Lamella oſſis palati*; and the anterior Extremity, which is broad and ragged, reſts on the tranſverſe Ridge of the *Os maxillare*, at the internal Root of the naſal Proceſs.

Beſide the two ſpongy Bones mentioned as Part

(a) Ephemerid. German. Cent. 1 & 2. obſerv. 135.

art of the *ethmoid* Bone, and theſe juſt now eſcribed, *Cowper (a)* mentions two others, ne in each Noſtril, that are ſometimes ound ſituated lower than any of them, and eem to be a Production of the Sides of the ma-illary *Sinus* turned downwards. When this ird Sort of ſpungious Bones is found, the iddle one of the three in each Noſtril is the rgeſt, and the loweſt is the ſmalleſt. *San-rini (b)* remarks, that there are often ſeveral ther ſmall Bones ſtanding out into the No-rils, that from their Shape might alſo deſerve e Name of *Turbinata*, but are uncertain in eir Bulk, Situation and Number.

Subſtance.

The Names of theſe Bones ſuffi-ently declare their Subſtance.

Connexion.

They are joined to the *Oſſa maxil-ria palati* and *unguis* in old Sub-cts, by a firm Union of Subſtance; d as this happens alſo frequently in People no great Age, *Santorini (c)* contends that ey ſhould be eſteemed Part of the Palate-nes.

Uſes.

Their Uſe is, to ſtraighten the No-ils, to afford a larger Surface for ex-nding the Organ of Smelling, to co-r Part of the *Antra maxillaria*, and to aſſiſt forming the Under-part of the lacrymal uct, the Orifice of which into the Noſe lies ncealed by theſe Bones.

In Children.

The *Oſſa turbinata* are complete en in a new born Infant.

(a) Drake's Anthropolog. Book 3. Chap. 10.
(b) Obſervat. Anatomic. cap. 4. § 9.
(c) Obſervat. Anat. cap. 4. § 7.

Vomer. *VOMER*, or Bone reſembling a Plough-ſhare, is the thirteenth of the upper Jaw, without a Fellow, forming the poſterior and inferior Parts of the *Septum narium*, and firſt deſcribed as a diſtinc Bone by *Columbus* (*a*) and *Fallopius* (*b*).

Figure. The Figure of this Bone is an irregular Rhomboid, the poſterior Side o which appears in an oblique Direction at the Back-part of the Noſtrils. The ſuperio Side is firmly united to the Baſe of the *ſphenoid* Bone, and to the naſal *Lamella* of the *ethmoid* and, when it can be got ſeparated, is hollow for receiving the *Proceſſus azygos* of the *ſphenoid*. The anterior Side has a long Furrow in it, where the middle Cartilage of the Noſt enters. The lower Side of the *Vomer* is firmly united to the naſal Spines of the maxillar and Palate-bones. Theſe Sides of this Bon are much thicker than the Middle, which is a thin as the fineſt Paper; by which, and the firm Union or Connexion this Bone has above an below, very ſeldom it can be ſeparated entire which I ſuppoſe is the Reaſon why Author have generally failed in the Deſcription ſome of the Parts of this Bone: But when it examined in a Child, the Mechaniſm of much more evidently diſcovers itſelf; wherefore I ſhall examine more particularly all i Parts, as they are to be found in ſuch a Subjec

Situation. Its Situation is not always perpendicular, but often inclined, as we as the naſal *Lamella ethmoidea*, to on Side.

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(*a*) De re Anatom. lib. 1. cap. 8.
(*b*) Obſervat. Anatom.

Deſcription.

Its ſuperior Edge (under which I omprehended the ſuperior and anerior Sides in the former Deſcrition) is a convex Arch behind, then becomes traight, as it runs down and forwards; and is ompoſed of two lateral Plates, the Extremiies of which have a great Number of ſmall Proceſſes, diſpoſed ſomewhat like the Teeth f a Saw, but more irregular, and ſeveral of hem are reflected back. Between theſe Plates deep *Foſſa* is left, which, ſo far as the Top f the Curvature, is wide, and has ſtrong Sides, or receiving the *Proceſſus azygos* of the *ſpheroid* Bone. Beyond the Arch forwards, the *Foſſa* is narrower and ſhallower gradually to he Point of the Bone, receiving for ſome Way he naſal *Lamella ethmoidea*, which is ſo cloſey united to the *Vomer* by the ſerrated Fringes iercing into its Subſtance, as in old People to revent any Separation; and beyond that, the niddle Cartilage of the Noſe fills up the *Foſſa*. The poſterior Edge of the *Vomer*, which apears above the poſterior Extremity of the Paate-bones, is broader above; but as it decends forwards, becomes thinner, tho' it is till ſolid and firm. The inferior Edge of this Bone, which reſts on the naſal Spine of the *Oſſa palati* and *Maxillaria*, has a ſmall Furrow on each Side of a ſmall middle Ridge, anſwerng to the Spines of the Bones of different Sides, nd the Interſtice between them. This Edge nds in a Point with the ſuperior.

Subſtance.

The Body of the *Vomer* has a ſmooth Surface, and ſolid, but thin Subſtance; and towards its Sides, where it is thickeſt, ſome *Cancelli* may be obſerved when the Bone is broke.

Connexion. It is joined, above, to the *ſphenoid* and *ethmoid* Bones, and to the middle Cartilage of the Noſe, by *Schindyleſis*; below, to the maxillary and Palate-bones, by a double ſort of *Schindyleſis*.

Uſes. The *Vomer* divides the Noſtrils, enlarges the Organ of Smelling, by allowing Place for expanding the *Membranam narium* on its Sides, and ſuſtains the Palate *Lamellæ* of the *Oſſa maxillaria* and *palati*, which otherwiſe might be in hazard of being preſſed into the Noſtrils, while the *Vomer* is ſecured from ſhuffling to one Side or other by the double *Schindyleſis*, with which it is joined to the Bones above and below.

Theſe then are all the Bones which compoſe the upper Jaw, except the Teeth, which are ſo much of kin to thoſe of the *Maxilla inferior*, that I rather chuſe to make one Deſcription ſerve for both, in which any Difference obſervable in either of them ſhall be remarked, and that after the ſecond Part of the Face is demonſtrated, because the Teeth cannot be well underſtood, until the Caſe in which they are ſet is explained: Wherefore we proceed to the

MAXILLA INFERIOR *;

Maxilla inferior. which conſiſts only of one moveable Bone, and ſixteen Teeth incaſed into it.

Figure. This Bone is ſomewhat of the Figure of the *Greek* Letter υ, ſituated at the

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* Γένυς, σιάγων, Mandibula, facies.

Divided.

the lower Part of the Face, ſo as its convex middle Part is forwards, and its Legs are ſtretched back. It is commonly divided into the Chin, Sides and Proceſſes. The Chin is the anterior middle Part, the extent of which is marked on the external Surface by the Holes obſervable there, and internally by the Beginning of an oblique Ridge. Beyond theſe the Sides appear, and are continued till the Bone, by bending upwards, begins to form the Proceſſes.

Mentum.

On the anterior Part of the Chin, a tranſverſe Ridge appears in the Middle, where the two Pieces of which this *Jaw-bone* formerly conſiſted are united. On each Side of this Ridge the *Muſculi quadrati*, or *Depreſſores labii inferioris*, and the *Elevatores labii inferioris Cowperi*, depreſs the Bone, for a Lodging to themſelves: And beow theſe Depreſſions a ſmall Riſing may be remarked, where the *Depreſſores* commence. On the poſterior Surface of the Chin, near the Line that marks the former Diviſion in Children, ſometimes three, always two ſmall Protuberances appear. To the uppermoſt, when it is ſeen, the *Frænum* of the Tongue is connected. From the Middle the *Muſculi geniogloſſi* riſe, and from the loweſt the *Geniohyoidei* have their Origin. Below the laſt, the *Digaſtrick* Muſcles are inſerted into two rough Sinuoſities.

Sides.

At the inferior and anterior external Part of each Side of the lower Jaw, a ſmall Riſing may be obſerved, where the *Depreſſor labiorum communis* riſes; and near the ſuperior Edge a Ridge runs length-ways, where the *Muſculus Buccinator* is inſerted. Internally, towards the upper Edge of each Side, another Ridge appears, from which the *Mylo-hyoidei* have their Origin, and to which the internal Membrane of the Gums adheres.

The ſuperior Edge of both Chin and Sides has a great many deep Pits or Sockets, for receiving the Roots of the Teeth. The Number and Magnitude of theſe Sockets are various, becauſe of the different Number, as well of the Teeth themſelves, as of their Roots, in different People. Theſe Sockets in both Jaws, when freed from the Teeth by any means, are ſome time after filled up with an oſſeous Network which at laſt becomes entirely ſolid, and as ſmooth as any other Part of the Bone, ſo that in a great many old Jaws one cannot obſerve any Veſtige of the Sockets: But then the Jaw becomes leſs, and much narrower, as *Veſalius (a)* obſerves; and ſometimes, when new Teeth are protruded, new Sockets, taken notice of by *Fallopius (b)*, are again formed. The inferior Edge of the Chin and Sides is ſmooth and equal, and is commonly called the Baſe of the lower Jaw: The Extremities of the Baſe are termed the *Angles*; the external Surface of each of which has ſeveral Inequalities upon it, where the *Maſſeter* Muſcle is inſerted; as the internal Surface alſo has, where the *Pterygoideus internus* is fixed.

Proceſſes. The Proceſſes are two on each Side. The anterior ſharp thin *Apophyſes* are named *Coronoid.* Round theſe

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(*a*) Anat. Lib. 1. Cap. 10.
(*b*) Obſerv. Anat.

theſe the *crotaphite* Muſcles are inſerted. The poſterior Proceſſes terminate in an oblong ſmooth Head, ſupported by a *Cervix*, and are ſtiled *Condyloid* *. The Heads, whoſe greateſt Length is tranſverſe, and whoſe Convexity is turned forwards, are tipp'd with a Cartilage, as the articulated Parts of all other moved Bones are. The Roots and Neck of theſe *Condyloid* Proceſſes are a little hollow and rough, where the *Pterygoidei externi* Muſcles are inſerted.

Foramina.

The *Foramina* of the lower Jaw are two on each Side; one at the Root of the Proceſſes internally, where a large Branch of the third Branch of the fifth Pair of Nerves and an Artery enter, and a Vein returns. From this generally either a ſmall ſuperficial Canal deſcends, or a Furrow is to be remarked, where a ſmall Branch of the ſame Nerve is lodged, in its Way to the *Mylo-hyoideus* Muſcle and ſublingual Gland, as *Palfyn* (*a*) has juſtly obſerved. The other Hole is external, at the Confines of the Chin, where theſe Veſſels come out. The Canal betwixt theſe two Holes is formed in the Middle of the Subſtance of the Bone, and is cribriform, or pierced by a great Number of ſmall Holes by which the Nerves and Blood-veſſels of the *Cancelli* and Teeth may paſs. The Extremity of this Channel is continued a little further than the external Hole at the Chin.

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* Articulatorii.

(*a*) Anat. Chirurg. traité 5. chap. 6.

Subſtance. The Surface of the lower Jaw is hard and firm, except at the ſpungy Sockets, where however it is ſtronger than the upper Jaw. The internal Subſtance of it is cellular; but at the Baſe, where it is moſt expoſed to external Injuries, the ſolid Sides of it are thick, which Thickneſs and Solidity of the Bone increaſes towards the Middle of the Chin, where the *Cancelli* of both Sides communicate.

Articulation. The lower Jaw generally receives into its Sockets the Roots of ſixteen Teeth, by *Gomphoſis*; and its *condyloid* Proceſſes, covered with Cartilage, are articulated with the *Oſſa temporum*, by what I called the third Species of *Ginglimus*, but in a manner that is not commonly deſcribed right: For, as was already narrated in the Deſcription of the temporal Bones, not only the Cavity between the *zygomatic*, *auditory* and *vaginal* Proceſs, but alſo the adjoining Tubercle at the Root of the *zygomatic* Proceſs of each *Os temporum* is covered with a ſmooth Cartilage, to facilitate the Motion of the *Condyles*, either in the Cavities or on the Tubercles, as different Occaſions require. 'Tis further obſervable, that an intermediate moveable Cartilage is here placed, which being thin in the Middle, and thick at the Edges, is concave on both Sides; and is ſo firmly connected by Ligaments to each *Condyle*, as to follow the Motions of the *Condyle*; and is ſo looſely faſtned to the *Os temporum*, as readily to change its Situation from the Cavity to the Tubercle, and to return again; while the common non Ligament of the Articulation affords pace enough for ſuch a Change of Place.

From which View of theſe Articulations we may eaſily conceive how the ſeveral Moions of the lower Jaw are performed: For vhile the Teeth of both Jaws coincide, the *Condyles* ſecurely play in the Cavity; but when he inferior Teeth are advanced forward, beond the Range of the ſuperior, the *Maxilla* eſts on the Tubercles, by which the neceſſary Advancement of this Bone is allowed; and otwithſtanding the Change of Place, a firm Axis of Motion is ſtill afforded: Tho' at the ame Time it muſt be granted, that in this training Poſition we cannot open our Mouths, nleſs by a convulſive Action of the Muſcles, nd then not without ſome Danger of a Luxaion of the *Condyles*, which often happens to ld People or Children in yawning. Whence he common Practice of Nurſes, in reſtrainng the Jaws of Children from opening too wide in that convulſive Motion, is far from nreaſonable. Theſe Cartilages alſo ſerve to ender the Articulations looſe enough for perorming the lateral Motions; and therefore, y a quick Succeſſion of the Motions forwards, to one Side, backwards, and then to he other Side, the *Condyles* may be moved n a Circle, which is of good Uſe in chewng (a).

Here a general Remark may be made, That where-ever ſuch moveable Cartilages are ound, either the articulated Bones are of ſuch

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(a) Vid. *Edinburgh* Medical Eſſays, and Obſerv. Vol. I. rt. 11, for a more full Account of this Articulation.

a Figure, or ſo conjoined and fixed by their Ligaments, that little Motion would be allowed without ſuch Cartilages; or ſome Motions are neceſſary to the right Uſe of the Member, which the Form of the Articulation would not otherwiſe admit of. This will more fully appear after the other Joints with ſuch Cartilages are deſcribed.

Of Infants. In a Child born to the full Time the lower Jaw is compoſed of two Bones, connected by a thin Cartilage in the Middle of the Chin which gradually oſſifies, and the two Bones intimately unite. In each of theſe Bones there are five Sockets for Teeth, as in the upper Jaw.

Uſes. After I have thus deſcribed the Incaſement of the Teeth, the Inſertion of ſo many Muſcles of the Tongue and of the *Os hyoides*, the Connexion of the Membrane of the Tongue to the maxillary Bone, and the Motions of this Bone, 'tis eaſy to deduce its Uſes, of being a principal Inſtrument in Manducation, Deglutition and Speech.

The Teeth. The *TEETH* are thoſe hard white Bodies placed in the Sockets of both Jaws. Their Number is generally ſixteen above, and as many below, tho' ſome People have more, others have fewer.

Baſe. The broad thick Part of the Teeth, which appears without the Socket, is the *Baſe* or Body *. The ſmaller Proceſſes ſunk into the *Maxilla* are the *Roots* or *Fangs*. At the Place where the Baſe ends, and the he Roots begin, there is generally a ſmall cirular Depreſſion, which ſome call the *Neck* r Collar.

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* Corona.

Without the Gums the Teeth are covered vith no Membrane, and they are ſaid to have o proper *Perioſteum* within the Sockets; but hat is ſupplied by the reflected Membrane of he Gums; which, after a good Injection, may e evidently ſeen in a young Subject, even vhen it is dried; and, as *Cowper* (a) has very vell remarked, it may be diſcovered in any Tooth recently pulled, by macerating it in Water. The Adheſion of this Membrane to heſe Roots is increaſed by the ſmall Furrows bſervable on them.

Subſtance.

Each Tooth is compoſed of two Subſtances; an external *Cortex*, which has no Cavity or ſpungy Subſtance for Marrow, and is ſo ſolid and ard, that Saws or Files can with Difficulty nake Impreſſion on it. This *Cortex* is thickſt upon the Baſe, and gradually, as the Roots urn ſmaller, becomes thinner, but not proortionally to the Difference of Magnitude bſervable in the Baſe and Roots. The Fires of this Enamel are all in a perpendicuar Poſition to the internal Subſtance, and are traight on the Baſe, but at the Sides are archd with the convex Part towards the Roots; that the Teeth will more ſtrongly reſiſt any Violence from the Compreſſion of a hard ody between the Jaws. Beſides which adantageous Texture of their Subſtance, the pungy Sockets in which they are placed will likewiſe ſerve better to prevent ſuch an Injury, than a more ſolid Baſe would have done. Notwithſtanding the great Hardneſs of this *Cortex*, it is waſted by Manducation. Hence the ſharp Edges of ſome Teeth are blunted and made broad, while the rough Surfaces of others are made ſmooth and flat.

(a) Anatomy Explicat, tab 92. fig. 7. lit E.

The internal Subſtance of the Teeth is Bone, with its Fibres running ſtraight according to the Length of the Teeth; which, when expoſed to the Air by the breaking or falling off of the hard *Cortex*, muſt ſoon corrupt or be deſtroyed, as is the Nature of all Bones: And thence carious Teeth are often all hollow within, when a very ſmall Hole only appears externally.

Channel. The bony Subſtance of the Teeth has a Channel formed in its Middle, wherein the Nerves and Blood-veſſels of the Teeth are lodged: which they certainly need, being conſtantly waſted by the Attrition they are ſubjected to in Manducation, and for their further Growth after they firſt appear. And it is certain, as *Ingraſſias* (a) juſtly affirms, that they are capable of becoming longer and broader in Adults; which does remarkably happen, when any Tooth of a young Perſon is taken out: For then the oppoſite one becomes longer, and theſe on each Side of the empty Socket turn broader; ſo that when the Jaws are brought together, it is ſcarce obſervable where the Tooth is wanting.

(a) De Tumor. cap. 1.

The Veſſels are eaſily traced as long
s they are in the large Channel, but *Veſſels.*
an ſcarce be obſerved in their Diſtri-
ution from that to the Subſtance of the Teeth
f Adults: *Ruyſch (a)* however affirms that he
ould, after Injection, trace the Arteries into
e hardeſt Part of the Teeth. In Children
have frequently injected the Veſſels of the
eeth as far as their Baſe: And in ſuch as are
ot entirely oſſified, one can with a lucky In-
ection fill ſo many Veſſels, as to make the
nſide of the cortical Part appear perfectly
ed. This plentiful Supply of Veſſels muſt
xpoſe the Teeth to the ſame Diſorders that
ttack other vaſcular Parts; and ſuch Teeth
s have the greateſt Number of Veſſels, muſt
ave the moſt numerous Chances of being
ized with theſe Diſeaſes.

Every Root of each Tooth has ſuch a di-
inct Canal with Veſſels and Nerves in it.
heſe Canals in the Teeth with more than
ne Root, come nearer each other, as they
pproach the Baſe of the Tooth, and at laſt
e only ſeparated by very thin Plates, which
eing generally incomplete, allow a Commu-
cation of all the Canals, and frequently one
ommon Cavity only appears within the Baſe,
which a pulpy Subſtance compoſed of
erves and Veſſels is lodged. The Condition
erefore of the Nerves here, bears a ſtrong
nalogy to that of the cutaneous Nerves which
rve for the Senſation of Touching. And ſee-
g the *Cuticula* can be rubbed off or cut with-
ut Pain, allows the Nerves to be affected by
Heat

(a) Theſaur. 10. num. 27.

Heat or Cold, and tranſmits acid or auſtere Liquors, that blunt the Touch conſiderably, and give an uneaſy Senſation at the ſame time; and that ſeveral Subſtances, notwithſtanding this interpoſed Membrane, do create a painful *Tremor*, by their numerous or frequently repeated Impulſes. When, I ſay, all this is reflected on, the analogous *Phæomena* in the Teeth, which the Ancients diſputed ſo much about, will appear to be of no difficult Solution.

The Entry of the Channels for theſe Veſſels, is a ſmall Hole, to be ſeen a little to a Side of the extreme Point of each Root; ſometimes this Hole is entirely cloſed up, and conſequently the Nerves and Blood-veſſels are deſtroyed, as M. *de la Hire* the younger (*a*) has remarked.

Formation.

The Teeth are ſeen a conſiderable Time in form of *Mucus* contained in a Membrane; afterwards a thin cortical Plate, and ſome few oſſeous Layers appear within the Membrane, with a large Cavity filled with *Mucus* in the Middle; and gradually this exterior Shell turns thicker, the Cavity decreaſes, the Quantity of *Mucus* is leſſened, and this Induration proceeds till all the Body is formed, from which the Roots are afterwards produced.

In young Subjects, different Stamina or Rudiments of Teeth are to be obſerved, one above the other, within the ſame Socket, the exterior of which hinder ordinarly the interior to make their Way out, while the interna pre

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(*a*) Hiſtoire de l'Acad. des. Sciences, 1699.

prevent the others from ſhooting their Roots, by which they come to be leſs fixed in the Sockets.

Shedded.

Children ſeldom have Teeth appearing without their Gums when new born, but when they are two Years old or little more have twenty, and their Number does not increaſe till about ſeven Years of Age, when thoſe that firſt made their Way through the Gums, are thruſt out by thoſe that have been formed deeper in the Jaw, and ſome more of the Teeth begin to diſcover themſelves farther back in the Mouth. About fourteen Years of Age, ſome more of thoſe that came firſt out are ſhedded, and the Number is increaſed. This Shedding of the Teeth is of good Uſe; for if the firſt Teeth had remained, they would have come to be at a great Diſtance one from another, becauſe the Teeth are too hard in their outer Cruſt, to encreaſe ſo faſt as the Jaws do. Whereas both the ſecond Layer, and the Teeth that come out late, meeting, while they are ſoft, with a conſiderable Reſiſtance to their Growth in Length, from thoſe ſituated upon them, will neceſſarly come out broad, and fit to make that cloſe Guard to the Mouth * we now ſee they form.

Connected.

The Teeth are joined to the Sockets by *Gomphoſis*, but are principally faſtned there by the Gums, as is evident by their falling out when the Gums are any Way deſtroyed, or made too ſpongy, as in the *Scurvy* or *Salivations*; whence ſeveral

O Authors

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* Φραγμὸς.

Authors claſs this Articulation with the *Syſſarcoſis.*

Uſes. The Uſes of the Teeth are to maſticate our Aliment, and to aſſiſt our Pronunciation of ſeveral Letters.

Diſtinguiſhed. Tho' theſe Bones ſo far agree in their Structure, yet becauſe of ſome Particulars wherein they differ, they are generally divided into three Claſſes, *viz. Inciſores*, *Canini* and *Molares*.

Inciſores. The *Inciſores* * are the four anterior Teeth in each Jaw, receiving their Name from their Office of cutting our Aliment, for which they are excellently adapted, being each formed into a ſharp cutting Edge at their *Baſe*, by the Extremity of their anterior Side turning inwards, while the poſterior Surface is ſlop'd down and hollowed †; ſo that they have the Form of Wedges, and therefore their Power of acting muſt be conſiderably increaſed, as is demonſtrated in the Mechanicks. Seeing in the Action of the *Inciſores*, a perpendicular Compreſſion is only neceſſary, without any lateral Motion, they are not ſo ſurely fixed in their Sockets as the other Teeth are, having neither ſo many nor ſo long Roots, but are only poſſeſſed of one ſhort Stump.

The Inciſores of the upper Jaw, are broader and longer generally than thoſe of the under Jaw, eſpecially the two middle ones †.

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* Γελασῖνοι, τομίκοι, διχαστῆρες κτένες τομεῖς, πρόσθιοι, ὀξεῖς, Riſorii, quaterii, primi, primores, anteriores acuti.

† Ὁλμίσκοι.

‡ Duales.

In a new born Infant, the outer Shell of the Body of theſe Teeth is only hardned. *Of Infants.*

Canini *, from the Reſemblance to Dogs Tusks, are one of each Side of the *Inciſores* in each Jaw: The two ſuperior are called *Eye-teeth*, from the Communication of Nerves which is betwixt them and the Eyes; and the two inferior are named angular or Wike-teeth, becauſe they ſupport the Angles of the Mouth. *Canini.*

The *Baſes* of the *Canini* are broader than thoſe of the *Inciſores*, tho' they are alſo ſloped on the interior Side. They are longer than any other Teeth, and ſtronger than thoſe of the former Claſs. The *Canini* of the upper Jaw are the largeſt and longeſt, and have the Extremity of their Roots crooked, and ſo are more firmly ſecured in their Sockets. Hence it is evident, how well theſe are adapted, for breaking and bruiſing ſolid Bodies, this being a Sort of mix'd Action betwixt cutting and grinding, the proper Offices of the other two *Claſſes*.

The *Canini* of a Child are formed much in the ſame Manner as the *Inciſores* are. *Of a Child.*

The *Dentes molares* or *Grinders* †, which have got their Name becauſe they grind our Food, are generally five in each Side of each Jaw, in all twenty. *Molares*

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* Κυνόδοντες, Riſorii, fractorii, collaterales, columellares.

† Μυλῖται, γόμφοι, μύλοι, πλατεῖς, φραστῆρες, maxillares, menſales, clavales Buccarum.

They are the broadeſt Teeth of any, with both Sides equally raiſed, or near ſo, but are unequal and ſcabrous in the Extremity of their Baſes, to be better fitted for their Office. The Body of the firſt is generally the leaſt, and comes neareſt to the *Canini* in its Shape. The third is the largeſt, and the fourth and fifth are next in Magnitude.

Some of the *Molares* have only one Root, others two, three, or four, to prevent their looſening by the lateral Preſſure they ſuffer; and in the upper Jaw, their Roots are commonly more numerous than in the lower, becauſe the ſuperior are more liable to fall out by their Situation and the Structure of their Sockets, as *Galen (a)* has well obſerved. The Number however of the Roots of each of them is very uncertain, ſometimes they are more, ſometimes fewer, frequently ſeveral Roots are joined together, at other times they are all diſtinct. The Diſpoſition of ſuch as are diſtinct is alſo various; for in ſome the Extremities of the Roots go out ſtreight, in others they ſeparate, and in others again they are crooked inwards. In general we obſerve, that the farther back in the Mouth theſe Teeth are ſituated, the Number of Roots is greater, and when they are united, we can ſtill diſtinguiſh them, by remarking the Number of ſmall Holes at their Points, which determine the Number of Roots the Tooth ought to be reckoned to have.

The cortical Subſtance at the Baſe of the *Grinders* is thinner than in any other Teeth.

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(*a*) De Oſſib. cap. 5.

Dentes ſapientiæ.

The two Teeth that are placed fartheſt back in each Jaw, are diſtinguiſhed by the particular Name of *Dentes ſapientiæ* *, becauſe they commonly cut the Gums about the twenty firſt Year of our Age, when the Laws allow People to be *ſui juris* and capable to manage their own Affairs.

Of Infants.

At the Time of Birth, only two *Dentes molares* in each Jaw have begun to oſſify, and that at little more than the Baſe, which has ſeveral ſharp Points ſtanding out from it.

Phænomena.

From what has been ſaid, the Anſwers of the following Queries may eaſily be deduced.

Why in Children do the *Dentes inciſores* firſt cut the Gums, the *Canini* next, and *Molares* laſt?

Why do Children ſhed their Teeth at a certain Age?

Wherefore have theſe *Temporanei* Teeth no Roots, or very ſmall ones?

How have ſome People got two Rows of Teeth in one or both Jaws?

Whence ariſe the new Sets of Teeth which ſeveral old People obtain?

Why are not the Gums of toothleſs old People torn by the hard Sockets in chewing?

Why are the Teeth inſenſible when ſlightly filed or raſped?

How come they to be ſenſible of Heat or

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* *Σωφρονιστῆρες, κραντῆρες ὀψίγονοι.* Senſûs, intellectûs, ſerotini, ætatem complentes, genuini, moderatores.

Cold, to be ſet on Edge by Acids, or to give ſuch an uneaſy Senſation, when gritty or ſandy Subſtances are rubbed between them?

What is the Reaſon of ſome Perſons dying convulſed upon raſping or filing down an overgrown Tooth?

What Parts are affected in the Tooth-ach?

Why are the *Dentes molares* moſt ſubject to that Diſeaſe?

How do the Teeth break and moulder away without any Pain in ſome People, and not in others?

Whence proceeds the violent obſtinate *Hæmorrhagy* which ſometimes attends the drawing of Teeth?

Why is it more difficult and dangerous to draw the Eye-teeth than any other?

What makes it impoſſible frequently to draw *Grinders* without bringing away Part of the Jaw Bone with them, or breaking the Fangs?

Why have ſmall Worms been ſometimes found in carious Teeth?

We ſhould now, according to the Diviſion made of the Skeleton, proceed to the Deſcription of the Trunk of the Body; but muſt firſt conſider a Bone, which cannot well be ſaid to belong to either Head or Trunk; nor is it immediately conjoined to any other, and therefore is very ſeldom preſerved with Skeletons; however it is generally deſcribed by Authors after the Bones of the Face. In obedience therefore to the prevailing Method, I ſhall next examine the Structure of the

*OS HYOIDES**. This Bone is ſituated in a horizontal Poſition, between the Root of the Tongue and the *Larynx*. It is properly enough named *Hyoides*, from the Reſemblance it bears to the *Greek* Letter υ, and may, for a clearer Demonſtration of its Structure, be diſtinguiſhed into its *Body*, *Cornua* and *Appendices*. *Os hyoides.*

The *Body* is the large middle broad Part, convex before, and hollow behind. *Body.* The convex anterior Surface is divided into two by a ſharp Ridge, into the Middle of which the *Mylo-hyoidei* Muſcles are inſerted, and laterally the *Stylo-hyoidei* are fixed. The Part of the anterior Surface above this Ridge is horizontal, but pitted in the Middle by the Inſertion of the two *Genio-hyoidei* Muſcles, and a little hollowed more laterally by the *Baſio-gloſſi*. The inferior Part of this anterior Surface is convex, but a little flatned in the Middle by the *Sterno-hyoidei*, and pitted more externally by the *Coraco-hyoidei*. The poſterior Surface of this Body of the *Os hyoides* is concave, but ſituated obliquely, ſo as to face backwards and downwards: Into this Concavity the *Thyroid* Cartilage is received, when the *Larynx* and this Bone are pulled nearer by the Action of the *Sterno-hyoidei* and *Hyo-thyroidei*; and to its ſuperior Edge the ligamentous Membrane of the *Epiglottis* and Tongue is fixed.

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* Hypſyloides, Lambdoides, παρεγστάτη, φαρυγγέτρον, Os gutturis, os linguæ, os morsûs Adami, aſſeſſor, os laude, Bicorne.

Cornua. The *Cornua* † of the *Os hyoides* are ſtretched backwards from each Side of its Body, where often a ſmall Furrow points out the former Separation; for in younger Subjects the Body and *Cornua* are not one continued Subſtance, as they come afterwards to be in Adults. Theſe *Cornua* are not always ſtreight, nor of equal Length; their two plain Surfaces ſtand obliquely, ſloping from above outwards and downwards. Into the anterior the *Cerato-gloſſus* is inſerted above, and the *Thyro-hyoideus* Muſcle below; and to the poſterior Surface the ligamentous Membrane of the Tongue and *Larynx* adheres. The *Cornua* become gradually ſmaller towards their Extremity where generally a ſmall rounded Tubercle may be obſerved, from which a movable Cartilage ſtands out, which is connected to the ſuperior Proceſſes of the *Cartilago thyroidea.*

Appendices. From the ſuperior Part of the Conjunctions of the Body of the *Os hyoides* with its *Cornua*, a ſmall Styliform Proceſs riſes upwards and backwards on each Side, which are called the *Appendices* *: Theſe are cartilaginous in young Subjects; and in Adults have one or more diſjointed Cartilages continued from them, which ſometimes in old People oſſify. *Ruyſch (a)* ſays, the Oſſification is continued to the temporal Bones in very old People, and joins the *Os hyoides* to them by *Anchyloſis.* Theſe terminate in a Ligament that is produced to the

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† Crura, Latera inferiora.

(*) Crura ſuperiora, Latera ſuperiora, Oſſa graniformia,

(a) Adverſ. Anat. Dec. 3 § 9.

Styloid Proceſſes of the *temporal* Bones: Into theſe *Appendices* the *Stylo-hyoidei alteri Douglaſſii* (a) are inſerted, and from thence Part of the *Hyo-gloſſi* take their Riſe.

Subſtance.

The Subſtance of the *Os hyoides* is cellular, but covered with a firm external Plate, which is of ſufficient Strength to bear the Actions of ſo many Muſcles as are inſerted into it.

Connexion.

It is not articulated with any Bone of the Body, except by the Connexion it has, by Means of the Muſcles and Ligaments mentioned.

Uſes.

The Uſe of the *Os hyoides*, is to ſerve as a ſolid Lever for the Muſcles to act with, in raiſing or depreſſing the Tongue and *Larynx*, or in enlarging and diminiſhing the Capacity of the *Fauces*.

At the Birth this Bone is in a cartilaginous State, excepting a ſmall Point of Bone in the Middle of the Body, and in each of the *Cornua*.

The ſecond Part of the *Skeleton* mentioned was the *Trunk*, the Deſcription of which I ſhall next proſecute.

Of the Trunk.

TRUNK. *Divided.*

THE *TRUNK* conſiſts of the *Spine*, *Pelvis* and *Thorax*.

SPINE.

The *SPINE** is that long Pile of Bones reaching from the *Condyloid* Proceſſes of the *Occiput*, to the Extremity of the Rump. It ſomewhat reſembles two unequal Pyramides, whoſe Baſes are commo or joined together. The Spine is not however ſtreight, but has four or five remarkable crooked Turns; for in deſcending from its ſuperio Part, it is made to advance forwards by th Force of the Muſcles, which pull the Hea and ſuperior *Vertebræ* back, being greater tha the contracting Power of the Flexors, an thereby it ſupports the *OEſophagus*, Veſſels o the Head, &c. Its middle gives Way backward to the Heart and Lungs, then it is again bende forwards, to ſupport the *Viſcera* of the *Abdomen*; afterwards a ſecond Time turns back for the Enlargement of the *Pelvis*; and, laſtly is reflected forwards for ſuſtaining the laſt great Gut. We ſhould however obſerve, tha notwithſtanding this crooked Figure of th Spine, it is ſo contrived, that the Center o Gravity of all that Part of it which ſuſtains any conſiderable Weight, falls on the Middle o the common Baſe.

(a) Myograph. chap. 12.

* Ῥάχις, νῶτον, ἄκανθα, ἱερὰ σύριγξ, σαλὴν, Tergum, Hominis Carina.

Divided. The *Spine* is commonly divided into *true* and *falſe Vertebræ*, the forme conſtituting the ſuperior long Pyrami with its Baſe inferior, while the *falſe Vertebræ* make the inferior ſhorter Pyramid, whoſ Baſe is ſuperior.

True Vertebræ. *TRUE VERTEBRÆ** are the twenty four ſuperior Bones o the *Spine*, on which the ſevera Motions of the Trunk of our Bodies are performed, from which Uſe they have juſtly got their Name.

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* Στροφεῖς, στρόφιγγες, Spondyli, oſſa orbiculata; oſſ vertebrata, verticula.

Each of theſe *Vertebræ* is compoſed of its Body and Proceſſes.

The Body is the thick ſpungy anterior Part, which is convex before, concave backwards, horizontal and plain in moſt of them above and below; their anterior and poſterior Surfaces having ſeveral remarkable Holes made in their thin external Plate, both for the firmer Connexion of the Ligaments, and for the Paſſage of Veſſels into their cellular Subſtance. *Bodies.*

Between theſe Bodies of each two adjoining *Vertebræ*, a Subſtance between the Nature of Ligament and Cartilage is interpoſed; which is compoſed of concentrical curve Fibres, the exterior of which are the moſt ſolid and hardeſt, while thoſe in the Centre, are very ſoft and full of a glairy Liquor, and therefore this Subſtance was not improperly called by the Ancients *Ligamentum mucoſum:* This is firmly fixed to the horizontal Surfaces of the Bodies of the *Vertebræ*, and therefore not only allows theſe Bones to recede from each other, and to be preſt cloſer together without breaking, but ſerves to connect them, in which it is aſſiſted by a ſtrong membranous Ligament, which lines all their concave Surface, and by ſtill a ſtronger Ligament that covers all their anterior convex Surface. This laſt it is, that *Blancard* (a) aſſures us he diſcovered to conſiſt of two Rows of tendinous *Fibres*, decuſſating each other in Form of X, ſo as to be alternately diſpoſed through all the *Vertebræ*, *i. e.* the 1, 3, 5, *Cartilages.*

(a) Anat. reformat. cap. 32.

5, 7, *&c.* ſhould be ſimilar, and the 2, 4, 6 8, *&c.* diſtinct from the firſt Claſs, but alik among themſelves.

We may lay down as a general Rule, notwithſtanding ſome Exceptions, that the *Bodie* of the *Vertebræ* are ſmaller and more ſolid above, but as we reckon downwards, appea larger and more ſpungy, and that the Cartilages between them are thick, and the ſurrounding Ligaments ſtrong in Proportion to th Largeneſs of the *Vertebræ*, and to the Quantity of Motion they are to perform: By whic Diſpoſition the greater Weight is ſupported o the broadeſt beſt ſecured Baſe, and the Middl of our Body is allowed a large and ſecur Motion, which is of conſiderable Benefit t us.

Proceſſes. From each Side of the Body of eac *Vertebra*, a bony Bridge is produce backwards and to a Side; from th *Oblique.* poſterior Extremity of which, on ſlanting Proceſs riſes and another deſcends; the ſmooth, and what is generally th flatteſt Side of each of theſe four Proceſſe which are called the *oblique* *, is covered wit a ſmooth Cartilage, and the two inferior oblique Proceſſes of each *Vertebra* are fitted t and articulated with, the two ſuperior or aſcending oblique Proceſſes of the *Vertebra* below

Tranſverſe. From between the ſuperior an inferior oblique Proceſs of eac Side, the *Vertebra* is ſtretched ou laterally in Form of a Proceſs, that is univerſally named *Tranſverſe.*

From

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* Articulatorii, minimi.

Spinal.

From the poſterior Roots of the two oblique and of the tranſverſe Proceſs of each Side, a broad oblique bony Plate is extended backwards, where theſe meet the ſeventh and laſt Proceſs of the *Vertebræ* takes its Riſe and ſtands out backwards; this being generally ſharp-pointed and narrow edged, has therefore been called *Spinal* Proceſs, from which this whole Chain of Bones has got its Name.

Beſides the common Ligament which lines all the interior Surface of theſe Proceſſes, as well as of the Bodies, there are particular Ligaments that connect the Proceſſes of each two contiguous *Vertebræ*.

Subſtance.

The Subſtance of the Proceſſes is conſiderably ſtronger and firmer than that of the Bodies of the *Vertebræ*, having a thicker external Plate, and without ſo many large Holes made in it.

Foramina.

The ſeven Proceſſes conſidered conjunctly, as forming the poſterior Shares of the *Vertebræ*, are hollow at their anterior middle Part; which Concavity joined with that at the poſterior Part of the Bodies, makes one great *Foramen*, which anſwers to ſuch another in the *Vertebra* above and below: Therefore the *Foramina* of all the *Vertebræ* taken together, form a long great Conduit *, which is widned or ſtraitned in Proportion to the Size of the *Medulla ſpinalis* which it contains.

In the lateral Bridges, which join the Bodies to the Proceſſes of each *Vertebra*, a ſemicircu-

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* Ἱερὰ, σύριγξ, σωλὴν, Canalis.

lar Notch is obſervable both above and below; which, exactly correſponding with others in the contiguous Bones, when the *Vertebræ* are joined, form a round Hole in each Side, between each two *Vertebræ*, through which the Nerves that proceed from the *Medulla ſpinalis* and the Blood-veſſels paſs.

Articulations. The Articulations then of theſe true *Vertebræ* are plainly double; for their Bodies are joined by *Synchondroſis*, and their oblique Proceſſes are articulated by the third Sort of *Ginglymus*. Hence it is evident that their Center of Motion is altered in different Poſitions of the Trunk: For when we bow forwards, the ſuperior moved Part bears entirely on the Bodies of the *Vertebræ*; if we bend back, the oblique Proceſſes ſupport the Weight; if we recline to one Side, we reſt upon the oblique Proceſſes of that Side and Part of the Bodies; if we ſtand erect, all the Bodies and oblique Proceſſes have their Share in our Support..

Advantages. Hence it follows: 1. That becauſe the Joints, of which the Spine is compoſed, are ſo numerous, the *Medulla ſpinalis*, Nerves, Blood-veſſels, *&c.* are not liable to ſuch Compreſſion and Overſtretching in the Motion of the Trunk of the Body, as they would be otherwiſe; ſince ſeveral *Vertebræ* muſt be concerned in every Motion of the Spine, and therefore a very ſmall Curvature is made at the Conjunction of any two *Vertebræ*. 2. That an erect Poſture is the ſureſt and firmeſt, becauſe the Surface of Contact of the *Fulcra* is largeſt, and the Weight is moſt perpendicular to them. 3. That the

Muſcles which move the Spine act with greater Force in bringing the Trunk to an erect Poſture, than in drawing it to any other: For in bending forwards, back, or to a Side, the Muſcles which perform any of theſe Actions are nearer the Centers of Motion; conſequently the Lever, with which they act, is ſhorter, than when the Center of Motion is on the Part of the *Vertebra* oppoſite to that where theſe Muſcles are inſerted, which is the Caſe in raiſing the Trunk. This is extremely neceſſary, ſince in the Deflexions of the Spine from a perpendicular Bearing, the Weight of the Body ſoon inclines it which way we deſign; whereas in raiſing us erect, this great Weight muſt be more than counteracted. 4. In calculating the Force exerted by the Muſcles which move the Spine, we ſhould with *Borelli* (a) and *Parent* (b) always make allowance for the Action of the Cartilages between the *Vertebræ*, which muſt, in every Motion from an erect Poſture, be ſtretched in one Side, and compreſſed on the other, to both which they will reſiſt; whereas in raiſing the Trunk, theſe Cartilages will aſſiſt by their ſpringy Force. 5. We are hence naturally led into the Reaſon of the *Phænomenon* obſerved by Mr. *Waſſe* (c), That our Height of Stature is increaſed in the Morning, and diminiſhed at Night: For the intermediate Cartilages of the *Vertebræ* preſſed all Day long by the Weight of our Body, in the Evening become more compact and thin; but when in the Night they are

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(a) De motu animal. pars 1. ſchol. ad Propoſ. 58.
(b) Hiſtoire de l'Acad. des Sciences 1702.
(c) Philoſoph. Tranſact. N°. 383. p. 87.

are relieved from this Preſſure, they again expand themſelves to their former Thickneſs; and ſeeing the Bulk of any Part muſt vary according to the different Diſtenſion or Repletion of the Veſſels compoſing it, we may underſtand how we become taller after a plentiful Meal, and decreaſe after Faſting or Evacuations, which Difference the *Abbé Fontenu* (*a*) has proved to depend moſtly, if not ſolely on the different Thickneſs of theſe Cartilages. 6. From the different Articulations of the Bodies and oblique Proceſſes of the *Vertebræ*, and the different Strength of the Ligaments, it is plain that they are formed ſo as to allow a much larger Motion forwards than backwards; this laſt being of much leſs Uſe, and might be dangerous by overſtretching the large Blood-veſſels that are contiguous to the Bodies of the *Vertebræ*.

Of Infants. The *Vertebræ* at the ordinary Time of Birth conſiſt of three bony Pieces, connected by Cartilages; to wit, the Body, which is not fully oſſified; and a long curved Bone of each Side, on which we ſee a little Share of the bony Bridge, the oblique Proceſſes complete, the beginning tranſverſe Proceſſes, and the oblique Plate, but no ſpinal Proceſs; ſo that the Teguments might be in no Danger of being hurt by the ſharp Extremities of theſe ſpinal Proceſſes, as they would be, if there were any ſuch ſharp bony Proceſſes, while a Child is in the bended Poſture it remains in in the Womb, nor by the Preſſure which it undergoes in the Birth.

From

(*a*) Hiſtoire de l'Acad. des Sciences 1725.

Diſeaſes.

From this general Mechaniſm of the Spine, an Account is eaſily deduced of all the different preternatural Curvatures the Spine is capable of: For if one or more *Vertebræ* are of unequal Thickneſs in oppoſite Sides, the Spine muſt be reclined over to the thinner Side; which now ſuſtaining the greateſt Share of the Weight, muſt ſtill be more compreſſed, conſequently hindred from extending itſelf in proportion to the other Side, which, being too much freed of its Burden, has Liberty to enjoy a luxuriant Growth. The Cauſes, on which ſuch an Inequality of Thickneſs in different Sides of the *Vertebræ* depend, may vary: For either it may be owing to an Overdiſtenſion of the Veſſels of one Side, and from thence a preternatural Increaſe of the Thickneſs of that Part; or, which more commonly is the Caſe, it may proceed from an Obſtruction of the Veſſels, by which the Application of proper Nouriſhment to the bony Subſtance is hindred, whether that Obſtruction depends on the faulty Diſpoſition of the Veſſels or Fluids, or if it is produced by an unequal mechanical Preſſure, occaſioned by a paralytick Weakneſs of the Muſcles and Ligaments, or by a ſpaſmodic Overaction of the Muſcles on any Side of the Spine, or by a Perſon's continuing long, or putting themſelves frequently into any particular Poſture declining from the erect Poſture: In all theſe Caſes one common Effect will follow, to wit, the *Vertebræ* turn thick on the Side where the Veſſels are free, and remain thin on the other Side where the Veſſels are ſtraitned or obſtructed. Whenever any morbid Curvature is thus made, almoſt neceſſarily a ſecond Turn, but in an oppoſite Direction to the former, muſt be formed. Both becauſe the Muſcles on the convex Side of the Spine being ſtretched, muſt have a ſtronger natural Contraction to draw the Parts to which their Extremities are fixed, and that the Patient will make Efforts to keep the Center of Gravity of his Body perpendicular to its Baſe, that the Muſcles may be relieved from a conſtant violent contractile State, which always creates Uneaſineſs and Pain.

When once we underſtand how theſe crooked Spines are produced, there will be little Difficulty in forming a juſt Prognoſis of our Patient's Diſeaſe, and a proper Method of Cure may be contrived, which muſt vary as to the internal Medicines, according to the different Cauſes on which the Diſeaſe depends; but one general Indication muſt be purſued by Surgeons, which is to counteract the bending Force, by increaſing the Compreſſion on the convex Part of the Curvature, and diminiſhing it on the concave Side. The Manner of executing which in particular Caſes muſt be very different, and requires a very particular Examination of the Circumſtances both of the Diſeaſe and Patient. In many ſuch Caſes I have found ſome ſimple Directions as to Poſtures in which the Patients Body ſhould be kept, of very great Advantage.

Hence alſo it is eaſy to deduce the Reaſon of old People generally bowing forwards, and at laſt being incapable to raiſe their Spine erect; ſince the Cartilages ſhrivel in becoming more ſolid: And as this muſt happen moſt and ſooneſt where theſe Griſtles are leaſt ſtretched and extended, therefore this Curvature is generally firſt moſt remarkable in the *Vertebræ* of their Back, or they become round-ſhoulder'd.

Divided.

Tho' the *true Vertebræ* agree in the general Structure which I have hitherto deſcribed, yet becauſe of ſeveral Specialities proper to a particular Number, they are commonly divided into three Claſſes, *viz. Cervical*, *Dorſal* and *Lumbar*.

Cervical.

The *Cervical* * are the ſeven ſuperior *Vertebræ*; which are eaſily diſtinguiſhed from the reſt by theſe Marks. They are all, except the firſt, of near an equal Breadth. Their Bodies are ſmaller and more ſolid than any others, and flatned on the Fore-part, to make place to the *OEſophagus*; or rather this flat Figure is owing to the Preſſure of that Pipe, and to the Action of the *longi Colli* and anterior *recti* Muſcles. The poſterior Surface, which is alſo flat, is generally rough, or has ſmall Proceſſes riſing from it, where the Ligaments are fixed. The ſuperior Surface of the Bodies of each *Vertebra* is made hollow, by a ſlanting thin Proceſs being raiſed on each Side; and the inferior Surface is alſo excavated, but in a different Manner from the former; for the poſterior Edge is raiſed a little, and the anterior is produced a conſiderable Way. Whence we ſee how the Cartilages between thoſe Bones will be more firmly connected,

Bodies.

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* Τράχηλȣ, αὐχὴς, Colli.

nected, and the Articulation of any two *Vertebræ* will be more ſecure.

Cartilages.

The Cartilages between theſe *Vertebræ* are thicker, eſpecially in reſpect of their Bulk, than thoſe belonging to the *Vertebræ* of the *Thorax*, becauſe of the larger Motion that is allowed here; and they are thickeſt at their Fore-part, which is one Reaſon of the *Vertebræ* advancing forward as they deſcend.

Oblique Proceſſes.

The oblique Proceſſes of theſe Bones of the Neck more juſtly deſerve that Name than thoſe of any other *Vertebræ*. They are ſituated ſlanting, the ſuperior Proceſſes having their ſmooth and almoſt flat Surfaces facing obliquely backwards and upwards, and the inferior oblique Proceſſes with theſe ſurfaces facing obliquely forwards and downwards.

Tranſverſe Proceſſes.

The tranſverſe Proceſſes of theſe *Vertebræ* are framed in a different Way from thoſe of any other Bones of the Spine: For beſides the common Proceſs riſing from between the oblique Proceſſes of each Side, there is a ſecond that comes out from the Side of the Body of the *Vertebræ*; and the two, after leaving a circular Hole for the Paſſage of the cervical Artery and Vein, being united, are conſiderably hollowed at their upper Part, with riſing Sides to protect the Nerves that paſs in the Hollow; and at laſt each Side terminates in a tuberculous Point, for the Inſertion of Muſcles.

Spinal Proceſſes.

The ſpinal Proceſſes of theſe cervical Bones ſtand pretty ſtraight backwards, are ſhorter than thoſe of any other *Vertebræ*, and are forked or double at their Extremity; and hence allow a more convenient Inſertion to the Muſcles, and a larger Motion backwards.

The Holes between the bony croſs Bridges, for the Paſſage of the Nerves from the *Medulla ſpinalis*, have their largeſt Share formed in the loweſt of the two *Vertebræ*, to which they are common.

The Subſtance of the cervical *Vertebræ*, eſpecially of their Bodies is not ſo porous or tender as of the other two Claſſes.

Diſtinguiſhed. So far the cervical *Vertebræ* agree in their general Characteriſticks, but ſtill have ſome particular Differences, which oblige us to conſider them ſeparately.

1. *Atlas.* The firſt, from its Uſe of ſupporting the globular Head, has got the Name of *Atlas* *; and by ſeveral Authors is called *Epiſtrophea*, from the Motion it performs on the ſecond.

The *Atlas*, contrary to all the other *Vertebræ* of the Spine, has no Body; but inſtead of it there is a bony Arch: In the anterior convex Part of which, a ſmall Riſing appears, where the *Muſculi longi colli* are inſerted; and on each Side of this Protuberance a ſmall Cavity may be obſerved, where the *Recti interni minores*, commonly (tho' wrongouſly) aſcribed to *Cowper*, take their Riſe. The ſuperior and inferior Parts of the Arch are rough and unequal, where the Ligaments that connect this *Vertebra* to the *Os occipitis* and ſecond *Vertebra*

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* Ἀστράγαλος.

bra are fixed. The poſterior Part of the Ar is concave, ſmooth, and covered with a Ca tilage in a recent Subject, to receive th Tooth-like Proceſs of the ſecond *Vertebr* This Hollow makes the Paſſage for the *Me dulla ſpinalis* ſeem much larger in this *Verteb* than in any other. On each Side of this Co cavity a ſmall rough Sinuoſity may be remark ed, where the Ligaments going to the Sid of the Tooth-like Proceſs of the following *Ve tebra* are faſtned; and on each Side a ſma rough Protuberance and Depreſſion is obſerv able, where the tranſverſe Ligament, whic ſecures the Tooth-like Proceſs in the Sinu ſity, is fixed, and hinders that Proceſs to in jure the *Medulla ſpinalis* in the Flexions of th Head.

The *Atlas* has no more ſpinal Proceſs tha Body; but inſtead of it there is a large bon Arch, that the Muſcles which paſs over thi *Vertebra* at that Place, might not be hurt in ex tending the Head back. On the poſterior an ſuperior Part of this Arch there are two Depreſſions, where the *Recti poſtici minores* tak their Riſe; and at the inferior Part are tw other Sinuoſities, into which the Ligament which connect this Bone to the following ar fixed.

The ſuperior oblique Proceſſes of this *Atla* are large and hollow, riſing more in their external than internal Brim; by which their Ar ticulations with the *Condyloid* Proceſſes of the *Os occipitis* are firmer; for, as I remarked from *Galen* (a) in the Deſcription of theſe *Condyles* they

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(a) De uſu partium, lib. 12. cap. 7.

hey cannot ſlip to either Side; and then this
rotuberance ſerves to defend the *Foſſa* or
hannel formed behind the external and poſte-
ior Part of each of them, in which the verte-
ral Arteries make the circular Turn, as they
re about to enter the great *Foramen* of the oc-
ipital Bone, and where the tenth Pair of
Nerves go out. The inferior oblique Pro-
eſſes are large, extended from within out-
wards and downwards, and are ſlightly hol-
owed: So that this firſt *Vertebra*, contrary to
he other ſix, receives the Bones with which it
s articulated both above and below.

The tranſverſe Proceſſes are not much hol-
owed or forked, but are longer and larger than
f any other *Vertebra Colli*, to ſerve for the
rigin and Inſertion of ſeveral Muſcles.
hoſe of the Muſcles fixed to the tranſverſe
roceſſes that ſerve to move this *Vertebra* on
he ſecond, gain a conſiderable Lever to act
ith, by the Diſtance which each of theſe long
roceſſes make from the *Axis* of Revolution.

The *Condyles* of the *Os occipitis* move for-
wards and backwards in the ſuperior oblique
roceſſes of this *Vertebra*, by means of their
ouble *Arthrodia*, which makes what I called
he third Species of *Ginglymus*; but very little
Motion can here be allowed to either Side, and
here muſt be ſtill leſs circular Motion, which
he *Head* obtains principally by the Circumvo-
ution of the *Atlas* on the ſecond *Vertebra*.

Of Infants.

In new born Children this *Verte-*
ra has only the two lateral Pieces
ſſified, the anterior Arch, which
has inſtead of a Body, being cartilagin-
us.

2. *Dentata.* The ſecond *Vertebra colli* is calle *Dentata*, from the Tooth-like Proceſs on the ſuperior Part of its Body. Some Authors call it *Epiſtrophea*; but improperly, ſince this Deſignation is only applicable to the firſt, which moves on this as an Axis.

The Body of this *Vertebra* is ſomewhat c a pyramidal Figure, the inferior Part bein large, and produced, eſpecially at its Fore ſide, to enter into a Hollow of the *Vertebr* below; while the ſuperior Part has a ſqua Proceſs, with a ſmall Point ſtanding out fro it. This it is that is imagined to reſemble Tooth *, and has given Name to the *Vertebra*. The anterior Surface of this Proceſs cylindrical, ſmooth, and covered with a Cartilage, where it plays in the Hollow of the anterior Arch of the firſt *Vertebra*. The poſterior Surface is much the ſame Way diſpoſe for moving on the croſs Ligament, which cartilaginous in the Middle. From the Side of the *Proceſſus dentatus*, the Ligaments go o to fix it to the firſt *Vertebra*; and from its Poi a ſtrong one is ſent out to the *Os occipitis*. Immediately below the two lateral Ligaments Sinuoſity may be obſerved on each Side, wher the firſt vertebral Nerves eſcape.

The ſuperior oblique Proceſſes of this *Vertebra dentata* are large, very near in a horizontal Poſition, and ſlightly convex, to be adapted to the inferior Proceſſes of the firſt *Vertebra*. A moveable Cartilage is ſaid by ſome Authors to be interpoſed between theſe ob lique Proceſſes of the firſt and ſecond *Vertebra*; but I could never find it. The inferior oblique Proceſſes of this *Vertebra dentata* anſwer exactly to the Deſcription given of thoſe common to all the cervical *Vertebræ*.

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* Conoides, Pyrenoides, Odontoides.

The tranſverſe Proceſſes differ from thoſe of the other cervical *Vertebræ* in this, that they are ſhorter, very little hollowed at their ſuperior Part, and not forked at their Extremities; and that the Canals through which the cervical Arteries paſs, are about the middle Subſtance of the Proceſs reflected outwards, ſo as the Courſe of theſe Veſſels may be directed towards the tranſverſe Proceſſes of the firſt *Vertebra*; which are further produced, and therefore make a Turn of the Arteries neceſſary: But if this had been any where in ſuch a moveable Part as the Neck is, and the Artery not defended by a Bone, and fixed to that Bone, ſcarce a Motion could be performed without the utmoſt Hazard of Compreſſion, and a Stop put to the Courſe of the Liquids, with all the Train of its ill Conſequences. Hence we obſerve this ſame Mechaniſm ſeveral times made uſe of, when there is any Occaſion for a ſudden Curvature of a large Artery. This is the third remarkable Inſtance of it we have ſeen: The firſt was the Paſſage of the *Carotides* through the *Oſſa temporum*; and the ſecond was that lately deſcribed in the vertebral Arteries, turning round the oblique Proceſſes of the firſt *Vertebra*, to come at the great *Foramen oſſis occipitis*.

The ſpinal Proceſs of this *Vertebra dentata* is thick, ſtrong and ſhort, to give ſufficient Origin to the *Muſculi recti majores*, and *obliqui inferiores*, and to prevent the Contuſio of theſe Muſcles in pulling the Head back.

In Children. This ſecond *Vertebra* conſiſts a the Birth of four bony Proceſſes; for beſides the three which I already mentioned as common to all the *Vertebræ*, the Tooth-like Proceſs of this Bone i begun to be oſſified in its Middle, and is joined as an Appendix to the Body of the Bone Whence we may deduce one good Reaſon why Midwives ought to apply Stay-bands t keep the Heads of new born Children from falling too far backwards, till the Muſcles attain Strength enough to be able to prevent tha dangerous Motion.

Motion. When we are acquainted with the Structure and Articulation of the firſ and ſecond *Vertebræ*, and know exactly the Strength and Connexion of their Ligaments, there is no Difficulty in underſtanding the Motions that are performed upon or by the firſt, tho' this Subject was formerly Matter of hot Diſpute among ſome of the greateſ Maſters of Anatomy. 'Tis none of my Purpoſe at preſent to enter upon a Detail of the Reaſons advanced by either Party, but to explain the Fact as any one may ſee it who will remove the Muſcles, which in a recent Subject hinder the View of theſe two Joints, and then will turn the Head into all the different Poſitions it is capable of. This done, he will obſerve the Head to move forwards and back on the firſt *Vertebra*, as was already ſaid; while this *Atlas* performs the *Circumgyratio* upon the ſecond *Vertebra*, the inferior oblique Proceſſes of the firſt *Vertebra* ſhuffling eaſily in a cir-

cula

cular way on the ſuperior oblique Proceſſes of the ſecond, and its Body or anterior Arch having a Rotation on the Tooth-like Proceſs, by which the perpendicular Ligament that is ſent from the Point of the Tooth-like Proceſs to the occipital Bone is twiſted, while the lateral Ligaments that fix the *Proceſſus dentatus* to the Sides of the firſt *Vertebra* are very differently affected, for the one upon the Side towards which the Face is turned by the *Circumgyratio* is much ſhortned and lax, while the oppoſite one is ſtretched and made tenſe, and yielding at laſt no more, prevents the Head from turning any further round on this *Axis*, ſo that theſe lateral Ligaments are the proper *Moderators* of the *Circumgyratio* of the Head here, which muſt be larger or ſmaller as theſe Ligaments are ſtronger or longer, and more or leſs capable of being ſtretched. Beſides this Revolution on this *Axis*, the firſt *Vertebra* can move a ſmall Way to either Side, but is prevented from moving backwards and forwards, by the anterior Arch of the firſt *Vertebra*, and by the croſs Ligament which is cloſly applied to the Tooth-like Proceſs. The Motion forwards here would have been of very bad Conſequence, as it would have brought the Beginning of the *Medulla ſpinalis* upon the Point of the Tooth-like Proceſs.

The Rotatory Motion of the Head is of great Uſe to us on many Accounts, by allowing us ſo quickly to apply our Organs of Senſe to Objects, and the *Axis* of Rotation was altogether proper to be here; for if it had been at a greater Diſtance from the Head, the Weight of the Head, if it had at any time been removed from a perpendicular Bearing to th ſmall very moveable Joint, and thereby ha acquired a long Lever, would, at every Tur inconſiderately performed, have broke the Ligaments to Pieces ; or theſe Ligaments muſ have been formed much ſtronger than coul well have been connected to ſuch ſmall Bones Neither cou'd this circular Motion be performed without Danger on the firſt *Vertebra* becauſe the immoveable Part of the *Medull oblongata* is ſo near, as at each large Turn th Beginning of the *Medulla ſpinalis* would hav been in danger of twiſting, and ſuffering by th Compreſſion this would make on its tende Fibrils. On the Whole, we may be convinced, that the quick circular Motion of ou Head is of good Uſe to us; and that this ſecond *Vertebra* of the Neck is altogether proper both by its Structure and Situation, for being the Axis on which that Motion is to be performed.

But then I muſt take notice that the lateral or as I called them the *Moderator* Ligaments confine the Motion of this Joint ſo much, tha tho' it may ſerve us in ſeveral Occaſions, ye we often require to turn our Faces ſo far roun as this Joint cou'd never allow, without th greateſt Danger of immediately twiſting th ſpinal Marrow too much, and alſo of the oblique Proceſſes of the *Vertebra* being luxated therefore in the large Turns of our Face backwards, we increaſe the Rotation by a little Aſſiſtance from each of the *Vertebræ* of the Neck, from the *Vertebræ* of the Loins, and from moſt of the Joints of the lower Extremities. This Combination of a great many

Joints towards the Performance of one Motion is alſo to be obſerved in ſeveral other Parts of the Body; notwithſtanding ſuch Motions being generally ſaid to be performed by ſome one Joint only.

The third *Vertebra* of the Neck is by ſome called *Axis*; but this Name 3. *Axis.* is given without any Reaſon to this third *Vertebra*, while it might be applied very properly to the ſecond. This third and the three below have nothing particular in their Structure, but all their Parts come under the general Deſcriptions formerly given, each of them being larger as they deſcend.

The ſeventh * *Vertebra* of the Neck comes near to the Form of thoſe of the 7. Back, having the upper and lower Surfaces of its Body leſs hollow than the others, the oblique Proceſſes are more perpendicular, neither ſpinal nor tranſverſe Proceſſes are forked. This ſeventh and the ſixth *Vertebræ* of the Neck have the Hole in each of their tranſverſe Proceſſes more frequently divided by a ſmall croſs Bridge, that goes between the cervical Vein and Artery, than any other *Vertebræ*.

The twelve *Dorſal* * may be diſtinguiſhed from the other *Vertebræ* *Dorſal.* of the Spine, by theſe proper Charaſteriſticks. Their Bodies are of a *Bodies.* middle Size, betwixt thoſe of the Neck and Loins; are more convex before than either of the other two Sorts, and flatned

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* Atlas quibuſdam, maxima, magna Vertebra, prominens.

* Θώρακος, μεταφρένȣ, νώτȣ, ὑποτραχήλιȣ, Antiſterni, pectoris, tergi.

laterally by the Preſſure of the Ribs, which ar inſerted into ſmall Cavities formed in the Sides. This Flatning on their Sides, whic makes the Figure of theſe *Vertebræ* near an hal Oval, is of good Uſe, as it affords a firme Articulation to the Ribs, allows the *Trache arteria* to divide at a ſmaller Angle, and th other large Veſſels to run ſecure from the A ction of the vital Organs. The poſterior Pa of theſe Bodies is more concave than in any c the other two Claſſes. Their ſuperior Surfaces are all horizontal, with their Edges tipped with *Epiphyſes*, which *Fallopius* (a) a ledges are only ſome Parts of the intervenin Ligaments become bony. The Cartilages interpoſed between the Bodies of theſe *Vertebr* are thinner than in any other of the true *Vertebræ*, and contribute to the Concavity of th Spine here at its Fore-part, by their being thinneſt near the anterior Edge of the *Vertebræ*.

Proceſſes.

The *oblique* Proceſſes are place almoſt perpendicular, the ſuperior ſlanting very little forwards, and the inferior as much back. Neither they, nor the oblique Proceſſes of the Bones of the Nec have as much Convexity or Concavity as i worth remarking. At their Roots a ſma Roughneſs is obſervable, where the Ligament that ſurround their Articulations are inſerted and on the poſterior Surface of the Bone, between the Proceſſes of oppoſite Sides, ſevera ſharp little Proceſſes ſtand out, where ſtron Ligaments are fixed.

The *tranſverſe* Proceſſes of the *dorſal Verte*

(a) Obſervat. Anatom.

bræ are long, thicker at their Extremity than in the Middle, and turned obliquely backwards, which may be owing to the Preſſure of the Ribs, the Tubercles of which are inſerted into a Depreſſion near the Extremity of theſe Proceſſes.

The ſpinal Proceſſes are long, ſmall pointed, and run ſloping down; and at the ſuperior Part of their poſterior Surface, a ſmall Ridge riſes, which is received by a ſmall Channel in the anterior Surface of the ſpinal Proceſs immediately above, which is connected to it by a Ligament. Hence little Motion can be allowed of here, leſt the Heart and Lungs ſhould be diſturbed in their Actions.

The *Conduit* of the *Medulla ſpinalis* is more circular, but correſponding to the Figure of that Cord, ſmaller here than in any other *Vertebræ*; and a larger Share of the Holes in the bony Bridges, for the Tranſmiſſion of the Nerves, is formed in the ſuperior than in the inferior *Vertebra*.

The Bodies of the four ſuperior *dor-*
ſal Vertebræ deviate from the Rule of 1---4.
the *Vertebræ* becoming ſtill larger as
they deſcend, for the firſt of theſe four is the largeſt, and the other three inferior gradually become ſmaller, to allow the *Trachea* and large Veſſels to divide at ſmaller Angles.

The two uppermoſt *Vertebræ* of the
Back, inſtead of being very prominent 1. 2.
forwards, are flatned by the Action of
the *Muſculi longi colli* and *recti majores*.

The proportional Magnitude of
the two little Depreſſions in the Bo- 1---4---12.
dy of each *Vertebra* for receiving

the Heads of the Ribs, ſeems to vary in reſpe
to each other, in this Manner; the Depreſſi
on the ſuperior Edge of each *Vertebra*, decre
ſes as far down as the fourth, and always a
ter that increaſes.

The tranſverſe Proceſſes are lo
1---7---12. ger in each lower *Vertebra* to t
ſeventh or eighth, with their ſmoo
Surfaces, for the Tubercles of the Ribs, faci
gradually more downwards; but afterwar
as they deſcend become ſhorter, and the ſmoo
Surfaces are directed more upwards.

The ſpinous Proceſſes of the *Ve*
1---8---12. *tebræ* of the Back become graduall
longer and more ſlanting from th
firſt, as far down as the eight or ninth *Verte*
bra, from which they manifeſtly turn ſhorte
and more erect.

The firſt * *Vertebra* beſides an oblon
1. hollow in its inferior Edge, that aſſiſts i
forming the Cavity wherein the ſecond Ri
is received, has the whole Cavity for the Hea
of the firſt Rib formed in it.

The ſecond has the Name of *Axillary* †
2. without any Thing particular in the Stru
cture of it.

The eleventh ‡ often has the whol
11. Cavity for the eleventh Rib in its Body
and wants the ſmooth Surfaces on eac
tranſverſe Proceſs.

The twelfth § always receives the
12. whole Head of the laſt Rib, and has n
ſmooth

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* Λοφία, Gutturalis.

† Μαχαλιςὴρ.

‡ Ἀῤῥεπὴς, in neutram partem inclinans.

§ Διαζώςηρ, præcingens.

ſmooth Surface on its tranſverſe Proceſſes, which are very ſhort. The ſmooth Surfaces of its inferior oblique Proceſſes face outwards as the *Lumbar* do. And indeed we may ſay in general, that the ſuperior *Vertebræ* of the Back come nearer the Reſemblance of thoſe of the Neck, while the inferior are liker the *Lumbar*.

The Articulation of theſe *Vertebræ* of the Back with the Ribs, ſhall be more particularly conſidered after the Ribs are deſcribed. Only it may be proper now to remark, that the Ligaments which ſerve that Articulation, aſſiſt in keeping the *Vertebræ* more cloſely connected.

Lumbar.

The inferior and laſt Claſs of the *True Vertebræ* is the *Lumbar* *, which five Bones may be diſtinguiſhed from any others by theſe Marks; 1. Their Bodies, tho' of a circular Form at their anterior Part, are ſomewhat oblong from one Side to the other, which may be occaſioned by the Preſſure of the large Veſſels, and of the *Viſcera* contiguous to that Fore-part. The *Epiphyſes* on their Edges are larger, and therefore the ſuperior and inferior Surfaces of their Bodies are more concave than in the *Vertebræ* of the Back. 2. The Cartilages between theſe *Vertebræ* are much the thickeſt of any, and render the Spine convex within the *Abdomen*, by their greateſt Thickneſs being anterior. 3. The oblique Proceſſes are ſtrong and deep, thoſe in oppoſite Sides being almoſt placed in parallel Planes, the ſuperior, which are concave, facing inwards; and

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* Οσφύος, ἰξύος, ψοιῶν, Renum, Lumborum.

the convex inferior ones outwards, and there
fore theſe *Vertebræ* do plainly receive each o
ther above, and are received below, which i
not ſo evident in the other two Claſſes alread
deſcribed. 4. Their tranſverſe Proceſſes ar
ſmall, long, and near erect, for allowing
large Motion to each Bone, and ſufficient In
ſertion to Muſcles, and for ſupporting and de
fending the internal Parts. 5. Betwixt th
Roots of the ſuperior oblique and tranſverſ
Proceſſes, a ſmall Protuberance may be ob
ſerved, where ſome of the Muſcles that raiſ
the Trunk of the Body are inſerted. 6. Thei
ſpinal Proceſſes are ſtrong, ſtreight and hor
zontal, with broad flat Sides, and a narrow
Edge above and below, this laſt being depreſ
ſed on each Side by Muſcles. And at th
Root of theſe Edges, we ſee rough Surface
for fixing the Ligaments. 7. The large Ca
nal for the *Medulla ſpinalis* is rather larger her
than in the Back. 8. The Holes for the Paſ
ſage of the Nerves are more equally forme
out of both the contiguous *Vertebræ* than in o
thers, but the ſuperior furniſhes however th
larger Share of it.

Both tranſverſe and ſpinal Proceſſes o
3. the middlemoſt *Vertebra* of the Loins ar
longeſt and thickeſt, and on each Side o
that they decreaſe, ſo that theſe Proceſſes of th
firſt * and fifth ‡ are the leaſt, which is ver
neceſſary, eſpecially as to the tranſverſe Pro
ceſſes of theſe two *Vertebræ*, leſt if they ha
been long, they had ſtruck on the Ribs or *Oſſ*
Iliûm

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* Νεφρίτης, renalis.

‡ Ἀχαλίτης, fulciens.

lium, or bruiſed the interpoſed Muſcles in the Deflexions of the Spine to a Side.

4. 5.

The *Epiphyſes* round the Edges of the Bodies of theſe *Vertebræ* are moſt raiſed n the two loweſt, and conſequently nake them appear hollower in the Middle, han the others are.

5.

The Body of the fifth *Vertebra* is rather hinner than that of the fourth. The ſpinal Proceſs of this fifth is ſmaller, and the oblique Proceſſes face more backwards and forwards, than in any other *Lumbar Vertebra*.

Uſes.

From the whole, we may deduce the Uſes of the true *Vertebræ* in theſe few eneral Heads. To give us an erect Poſture; to allow a ſufficient and ſecure Motion o the Head, Neck, and Trunk of the Body n all neceſſary Occaſions; and to ſupport and efend the *Viſcera* and other ſoft Parts.

Secured from Luxations.

After conſidering the Structure of he particular *Vertebræ*, and their mutual Connexion, we may obſerve n each a ſollicitous Care taken that hey ſhall with great Difficulty be disjoined; or their Bodies enter either ſo into each other, s to prevent their being diſplaced any how, as n the *Vertebræ* of the Neck; or theſe Bodies are rop'd on all Sides, as theſe of the *Back* are by he Ribs; or their Surfaces of Contact are ſo road, and the Ligaments ſo ſtrong and firmly onnected, as to render the Separation almoſt mpracticable, as in the *Loins*; while the Depth nd Articulation of the oblique Proceſſes are xactly proportioned to the Quantity of Motion the other Parts of the Bone will allow, or he Muſcles can perform: Yet as theſe oblique

Proceſſes are ſmall, and therefore not capab of ſo ſecure a Conjunction as the larger Bo dies, they may ſooner yield to a disjoinin Force; but then their Diſlocation is not c near ſo bad a Conſequence: For by their bein diſplaced, the Muſcles, Ligaments and *Me dulla ſpinalis* are indeed ſtretched; wherea when the Body of the *Vertebra* is removed ou of its Place, the *Medulla ſpinalis* muſt be com pletely compreſſed, or entirely deſtroyed.

Falſe Vertebræ.

The *FALSE VERTEBR* compoſe the under Pyramid of th *Spine*. They are diſtinguiſhed fro the former juſtly enough by th Epithet of *Falſe*, becauſe tho' each Bone r ſembles the true *Vertebræ* in Figure, yet no of them partake of their Uſe of ſerving in t Motion of the Trunk of the Body, all of the being intimatley united, except at one Pa where there is a movable Joint; whence t common Diviſion of theſe falſe *Vertebræ* in two Bones, *Os ſacrum* and *Coccygis*.

Os ſacrum.

*OS SACRUM**, is ſo call from being offered as a dainty in Sacrifice, or rather becauſe its Largeneſs in reſpect of the other *Vertebr* This Bone is of an irregular triangular Sha broad above, narrow below, convex behi for the advantageous Origin of the Muſcl that move the *Spine* and Thigh back, and co cave before, for enlarging the Cavity of t *Pelvis*. In young Subjects, it may be eaſ ſeparated into five Bones; nay, in Adults, fo

Veſti

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* Ἱερὸν, σπονδύλος μεγάς. Hippocrat. ὑποσπονδύ Oribas. Πλατὺ, Latum, Os Clunium, Clavium.

Veſtige of this Diviſion is obſervable on its anterior Surface, and within the great Canal that runs through the Middle of it; but on its poſterior Surface and Sides, there are no ſuch evident Marks of a former Diſtinction; however, we can ſtill determine the ſeveral Parts that belong to each of theſe Bones.

Body. The anterior ſpungy Part of the *Os ſacrum*, analogous to the Bodies of the true *Vertebræ*, is ſmooth and flat before, to allow a larger Space for the contained *Viſcera*, without any Danger of hurting them; or this flat Figure may be owing to the equal Preſſure of theſe *Viſcera*; the back Part of theſe ſame Bodies are almoſt ſtraight without the concave Curve remarked in the *Vertebræ*, becauſe as the Bones of the *Os ſacrum* have no ſuch Motion, there is no Occaſion for ſuch a large Cavity to lodge the *Medulla ſpinalis*: Beſides, that Cord is now become ſo ſmall, that it has ſeparated into the Number of Nerves reſembling the *Cauda equina*, therefore requires a leſs Canal. The Bridges between the Bodies and Proceſſes of this Bone, are much thicker, and in Proportion ſhorter, than the former Claſs of Bones enjoys. The Strength of theſe croſs Bridges is very remarkable in the three ſuperior Bones, and is well proportioned to the heavy Weight of the Trunk of the Body, which theſe Bridges ſuſtain in an unfavourable tranſverſe Situation.

Oblique Proceſſes. The only oblique Proceſſes of the *Os ſacrum* are two that appear, one of each Side, ſtanding out from the ſuperior Part of the firſt Bone. Their plain erect Surface faces backwards, and receives the inferior oblique Proceſſes of the la *Vertebra* of the Loins, to which theſe Proce ſes are connected by a ſtrong Ligament, whic riſes from a ſcabrous Cavity round the Ro of theſe Proceſſes, where mucilaginous Glan are alſo lodged.

Tranſverſe Proceſſes.

The tranſverſe Proceſſes here a all grown together into one larg ſtrong oblong Proceſs of each Side which, ſo far as it anſwers to the fir three Bones, is very thick, and divided int two irregular Cavities, by a long perpendicular Ridge. The anterior Cavity has commo ly in the recent Subject, a thin cartilagino Skin covering it, and is adapted to the unequ Protuberance of the *Os Iliûm*, and a ſtro Ligament connects the Circumference of the Surfaces of the two Bones. The poſterior Cavity is divided by a tranſverſe Ridge into tw where a cellular Subſtance, containing generally *Mucus*, and ſtrong Ligamentous String that go from this Bone to the *Os Iliûm*, a lodged.

The tranſverſe Proceſſes of the two la Bones of the *Os ſacrum* are much ſmaller tha the former, and are rough and porous whe the *Glutæi maximi* and *Pyriformes* Muſcl have their Origin; and a ſtrong Ligament, th is extended from the *Oſſa Iliûm* and Tuber ſity of the *Iſchiûm*, is fixed.

Spinal Proceſſes.

The ſpinal Proceſſes of the thr uppermoſt Bones of the *Os ſacru* appear ſhort, ſharp, and near erec while the two inferior are open behind, and ſometimes a little Knob is to be ſee on the fourth, tho' generally this fourth is b

furcate

furcated without the two Legs meeting into a *Spine*, in which Condition alſo the firſt is often to be ſeen, and ſometimes none of them meet, but leave a *Sinus* or rather *Foſſa*, inſtead of a Canal, as *Verheyen (a)* remarks. From the Sides of theſe ſpinal Proceſſes the *Muſculus ſacer* has its Riſe.

Holes.

The Canal between the Bodies and Proceſſes of this Bone, for the *Cauda equina*, is triangular, and becomes ſmaller as it deſcends, as the *Cauda* alſo does. Below the third Bone this Paſſage is no more a complete bony Canal, but is open behind, and is only there defended by a ſtrong ligamentous Membrane ſtretched over it, which, with the Muſcles that cover it, and are very prominent on each Side, is a ſufficient Defence for the Bundle of Nerves within.

At the Root of the oblique Proceſſes of this Bone, the Notch is conſpicuous, by which, and ſuch another in the laſt *Vertebra* of the Loins, a Paſſage is left for the twenty fourth ſpinal Nerve; and in both anterior and poſterior Views of the *Os ſacrum*, four large Holes appear, in much the ſame Height of the Bone, as where the Marks of the Union of its ſeveral Bones remain. Some of the largeſt Nerves of the Body paſs thro' the anterior Holes; but the poſterior are in a good Meaſure covered by ſtrong Membranes ſtretched on them, tho' they ſtill tranſmit larger nervous Filaments than ſome Authors would have us believe. The two ſuperior of theſe Holes, eſpecially on the Foreſide, are the largeſt; and as the Bone de-

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(a) Anat. Tract. 5, cap. 9.

ſcends, the Holes turn ſmaller. Sometime a Notch is only formed at the lower Part o this Bone, and in other Subjects there is a Hol to be ſeen, common to this Bone, and the *O Coccygis*, through which the twenty ninth ſpinal Nerve paſſes, and frequently a bony Bridg is formed on the back Part of each Side by Proceſs ſent up from the poſterior Part of th *Os Coccygis*, and joined to the little Knob which the laſt Bone of the *Os ſacrum* has inſtead of a ſpinal Proceſs; under this Bridge o *Jugum*, that twenty ninth ſpinal Nerve run in its Courſe to the common Hole juſt no deſcribed.

The ſuperior Surface of the Body of th firſt Bone reſembles the *Vertebræ* of the Loins but the fifth Bone ends commonly in an oblong Sort of Head, which is ſomewhat hollow in the Middle.

Subſtance. The Subſtance of the *Os ſacru* is very ſpungy, without any conſiderable ſolid external Plates, and i perhaps lighter than any other Bone in the Body of the ſame Bulk; but is ſecured from Injuries by the thick Muſcles that cover it externally, and by the ſtrong ligamentous Membranes that cloſely adhere to it. As this is on of the moſt remarkable Inſtances of this Sor of Defence afforded a ſoft weak Bone, w may make the general Obſervation, Tha wherever we meet with ſuch a Bone, one o other, or both theſe Defences are made Uſ of; the firſt to ward off any Injury, and th ſecond to keep the Subſtance of the Bon from yielding too eaſily.

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This Bone is articulated above to the laſt *Vertebra* of the Loins, in much the ſame Manner as the other *Vertebræ* are, and therefore, the ſame Variety of Motion may be allowed. The Articulation of the *Os ſacrum* at its inferior Part to the *Os Coccygis*, ſeems well enough adapted for allowing a conſiderable Motion to this laſt Bone, was it not much confined by the Ligaments which are produced from the Sides of the articulated Bones, to others which are immoveable. Laterally the *Os ſacrum* is conjoin'd to the *Oſſa Iliûm*, by an immoveable *Synchondroſis*, or what almoſt deſerves the Name of Suture; for the cartilaginous Cruſt on the Surface of the Bones is very thin, and both their Surfaces are ſo ſcabrous and unequal as to be indented into each other. Very often the two Bones grow together in old Subjects, ſo that I cannot conceive how a Separation ſhould here be made in Child-bearing, without immediate Deſtruction, or the greateſt Inconveniency ever after to the Mother, as we ſee happened in the Caſe related by *Ludovicus (a)*, ſince ſuch is the natural Coheſion of theſe Bones, that tho' ſtripped of their Muſcles and Ligaments, they are not to be ſeparated with leſs Force than that of a ſtrong Man aſſiſted by a long Lever. *Articulation.*

The Uſes of the *Os ſacrum* are to ſerve as the common Baſe and Support of the Trunk of the Body, to guard the Nerves proceeding from the Extremity of the ſpinal Marrow, to defend the Back Part of the *Uſes.*

Pelvis,

(a) Ephem. German, Dec, 1. Ann. 2. Obſ, 254.

Pelvis, and to afford a ſufficient Origin to th Muſcles which move the Trunk and Thigh.

In Children. The Bones that compoſe the *O ſacrum* of Infants, have their Bo dies ſeparated by a thick Cartilage and each of theſe Bones conſiſts of three Piece joined by Cartilage, as the *Vertebræ* do, th poſterior Extremities of the two lateral Piece being ſcarce brought contiguous in any co them.

Os Coccygis. *OS COCCYGIS* *, or *Rump bone*, is that irregular Chain co Bones depending from the *O ſacrum*, each Bone becoming ſmaller as the deſcend, till the laſt ends almoſt in a Poin The poſterior Surface of the *Os Coccygis* i convex, and the anterior is concave, from which crooked Pyramidal Figure, this Bon has got its Name, becauſe of the imaginar Likeneſs it was thought to have to a Cuckow' Beak.

Divided. This Bone conſiſts of four ſevera Pieces in People of a middle Age In Children very near the whole of i is Cartilage; and in old Subjects, all the Bone are united, and become frequently one con tinued Bone with the *Os ſacrum*.

1. The higheſt of the four Bones is th largeſt, with Shoulders extended farthe to each Side than the Extremity of th *Os ſacrum*; which Enlargement, ſhould in m Opinion ſerve as a diſtinguiſhing Mark t fix the Limits of either Bone, and therefore ſhould take away all Diſpute about reckoning the Number of Bones, one or other of theſe two Parts of the *Falſe Vertebra* is compoſed of, which muſt ſtill be kept up, as long as the Numbering five or ſix Bones in the *Os ſacrum*, depends upon the uncertain Accident of this broad-ſhoulder'd little Bone being united to, or ſeparated from it. The ſuperior Surface of this Bone is a little hollow. From the Back of that bulbous Part called it's Shoulders, a Proceſs often riſes up on each Side, to join with the bifurcated Spine of the fourth and fifth Bones of the *Os ſacrum*, to form that bony Bridge mentioned in the Deſcription of the former Bone, and ſometimes the Shoulders of this firſt Bone are conjoined to the Sides of the fifth Bone of the *Os ſacrum*, to form the Hole common to theſe two Bones, for the Paſſage of the twenty ninth ſpinal Nerve. Immediately below the Shoulders of the *Os Coccygis*, a Notch may be remarked on each Side, where the thirtieth Pair of the ſpinal Nerves paſs. The inferior Part of this Bone is formed into a ſmall Head, which very often is ſomewhat hollow in the Middle.

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* Ὀῤῥοπύγιον, ὄῤῥος, Caudæ Os, Spondylium, O Cuculi.

The three inferior Bones gradually become ſmaller, and are very ſpongy, but are ſtrengthned by a firm ſtrong Ligament which covers them. Their Extremities, by which they are articulated, are formed in the ſame Manner as the firſt is.

Between each of theſe four Bones, except when they are grown together, a Cartilage is interpoſed, ſo that their Articulation is ſomething analogous to that of the Bodies of the *Vertebræ* of the Neck; for, as has been above re-

remarked, the under Extremity of the *Os ſ* *crum*, and of each of the three ſuperior Bone has a ſmall Head hollowed in the Middle, an the ſuperior Part of all the Bones of the *O* *Coccygis* is a little concave, and conſequentl the interpoſed Cartilages are thickeſt in th Middle, to fill up both Cavities by which the connect the Bones more firmly. When th Cartilages oſſify, the ſuperior Extremity o each Bone is formed into a Cavity exactly adapted to the round Head of the lower Extremity of the Bone immediately above. From this Sort of Articulation, it is therefore evident, that all of them, while in this Condition, are capable of Motion, of which th firſt and ſecond, eſpecially this laſt, enjoys th largeſt Share.

The inferior Extremity of the fourth Bon terminates in a rough Point to which a Cartilage is appended.

Into the Sides of theſe Bones of the *Os Coccygis*, the *Coccygæi* Muſcles of *Douglas* (a), o rather of *Euſtachius* (b) are inſerted, and t them the ſtrong Ligaments extended from th *Oſſa Iſchiûm* are fixed, and from them a conſiderable Share of the *Muſculi levatores An* takes its Origin.

Subſtance. The Subſtance of theſe Bones i very ſpungy, and in Children cartilaginous, there being only a Part o the firſt Bone oſſified in a new born Infant ſince therefore the *Levatores Ani* have not ſuc a firm Origin, nor the *Inteſtinum rectum* ſuc ſtrong Support in Children, it would appear no unreaſonable Concluſion of *Spigelius (a)* and *Paaw (b)*, that the Weakneſs and Flexibility of this Part, may be one Cauſe of Children being more ſubject to a *Procidentia Ani* than old People.

(a) Myograp. chap. 40.
(b) Tab. 36. No, 45. 20.

From the Deſcription of this Bone, we ſee how little it reſembles the *Vertebræ*, ſince it ſeldom has Proceſſes, never has any Cavity for *Medulla ſpinalis*, nor Holes for the Paſſage of Nerves. And from the Connexion it has by ſtrong Ligaments to the *Oſſa Innominata*, we may be convinced, that the Motion it enjoys cannot be to either Side, and is pretty much confined backwards and forwards: Yet as the Ligaments can be ſtretched by a conſiderable Force, it is a great Advantage in the Excretion of the *Fæces alvinæ*, and much more in Child-bearing, that this Bone ſhould remain moveable, otherwiſe, as in Women who are old before they are Mothers, the Birth muſt be difficult and hazardous. *Paaw (c)* aſſures us from his repeated Experience, that he has ſeen very great Inconveniencies and Danger from this Bone not being allowed to recede back in the Time of Birth, and as ſpeedy a Delivery after aſſiſting the Head of the Child to puſh the *Os Coccygis*. Nay *Deventer (d)* ſeems to put a large Share of the Art of Midwifery on the right Management of this Bone, and boaſts of the Rules he lays down for that Operation, as one of the greateſt Diſcoveries he had made

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(a) De humani corp. fabric. lib. 2. cap. 32.
(b) De Oſſib. pars 2da. cap. 3.
(c) Ibid.
(d) Operat. Chirurg. cap. 27.

Uſus. The *Os Coccygis* ſerves to ſuſtain the Extremity of the *Inteſtinum rectum*; and in order to perform this Office more effectually, it is made to turn with ſuch a Curve forwards, by which alſo the Bone itſelf, the Muſcles and Teguments are preſerved from any Injury when we ſit with our Body reclined back.

PELVIS. In the Deſcription of the *Os ſacrum* I mentioned its firm Connexion on each Side to the *Oſſa innominata*, which, with that Bone and *Os Coccygis* form the bony Sides of the cylindrical Cavity, which the *Abdomen* is contracted into a its lower Extremity, and univerſally known by the Name of *PELVIS*. I mentioned thi as the ſecond of the Parts into which the Trunk of the Body is divided, and therefore to complete the Deſcription of the bony Par of this Cavity, I ſhall next conſider the Structure of theſe *Oſſa innominata*, notwithſtanding I know them accounted by ſeveral Anatomiſts to belong to the *inferior Extremities*

Oſſa innominata. *OSSA INNOMINATA* *. The Name of theſe Bones, tho' of no Import to know their Situation Structure or Office by, is moſ commonly uſed, even by Authors, who have generally been very liberal in beſtowing Variety of Names on other Bones; long Uſe has made it now ſo familiar, and ſuch a Diſtinction from all others, as gives no occaſion for changing it.

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* Σκελέων, προσφύσεις. Sacro conjuncta.

The *Oſſa innominata* are two large broad Bones, that form the Fore-part *Divided.* and Sides of the *Pelvis*, and the inferior lateral Parts of the *Abdomen*. In Children each of theſe Bones is evidently divided into three; which are afterwards ſo intimately conjoined, that ſcarce the leaſt Mark of their former Separation remains: But ſtill however they are deſcribed as conſiſting each of that Number of Bones, to each of which proper Names are given. In obedience therefore to this prevailing Cuſtom, I ſhall ſeparately deſcribe the *Os Iliûm*, *Iſchiûm* and *Pubis*, (for ſo are the Parts of each *Os innominatum* called,) and ſhall point out the Parts particular to each, and afterwards conſider what is common to any two, or to all three of them.

OS ILIUM [*], or Haunch-bone, is the ſuperior broad Bone that *Os Iliûm.* reaches about as far down as a tranſverſe Section of one Third of the great *Acetabulum* or Cavity with high Brims, where the Head of the Thigh-bone is received.

The external Side of this Bone is unequally convex, and is called its *Dorſum*; the internal concave Surface is by ſome (but improperly) named its *Coſta*. The ſuperior ſemicircular Edge, tipped with a Cartilage in the recent Subject, is named the *Spine*, into *Spine.* which the external or deſcending oblique Muſcle of the *Abdomen* is inſerted; and from it the internal aſcending oblique and the tranſverſe Muſcles of the Belly, with the *Glu-*

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[*] Λαγόνων, κενεῶν, Scaphium, lumbare, clunium, claium, anchas.

Glutæus maximus and *latiſſimus Dorſi* ha
their Origin. *Winſlow (a)* is of Opinion, th
it is only the tendinous Cruſt of all theſe Mu
cles, and not a Cartilage, as commonly a
ledged, that covers this bony Edge. The E
tremities of the Spine are more prominent th
the Surface of the Bone below them, ther
fore are reckoned Proceſſes. From the Poi
of the anterior ſpinal Proceſs the *Sartori*
Muſcle has its Riſe, and from the Outſide
this Proceſs the *Muſculus faſcialis* takes is O
gin. The Inſide of the poſterior ſpinal Pr
ceſs, and of Part of the Spine forward fro
that, is made flat and rough where the *Sacr*
lumbalis and *longiſſimus Dorſi* riſe. Below t
anterior ſpinal Proceſs another Protuberan
ſtands out, which by its Situation may be c
ſtinguiſhed from the former, as *Baker (b)* h
done, by adding the Epithet of *inferior*, whe
the *Muſculus rectus Tibiæ* has its Origin. B
twixt theſe two anterior Proceſſes the Bone
hollowed, where the Beginning of the *Sar*
rius Muſcle is lodged ſafe from external I
juries. Below the poſterior ſpinal Proceſs
ſecond Protuberance of the Edge of this Bo
is in like manner obſervable, which is cloſe
applied to the *Os ſacrum*. Under this laſt Pr
ceſs a conſiderable large Niche is obſerva
in the *Os Iliûm*, which with the ſtrong Lig
ment that is ſtretched over from the *Os ſacru*
to the *Iſchium* of the recent Subject forms
large Hole thro' which the great ſciatic Ner

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(*a*) Expoſition Anatomique du corps humain tra
des Os frais, § 96.

(*b*) Curſ. Oſteolog. demonſt. 8.

and the poſterior crural Veſſels paſs, and are protected from any Compreſſion.

Dorſum.

The external broad Side or *Dorſum* of the *Os Iliûm* is a little hollow towards the anterior Part, farther back it is as much raiſed, then is conſiderably concave, and laſtly it is convex. Theſe Inequalities are occaſioned by the Actions of the Muſcles that are ſituated on this Surface. From behind the ſuperior anterior ſpinal Proceſs, in ſuch Bones as are ſtrongly marked by the Muſcles, a ſemicircular Ridge is extended to the hollow Paſſage of the ſciatic Nerve. Between the Spine and this Ridge the *Glutæus maximus* takes its Riſe; then, immediately from above the anterior inferior ſpinal Proceſs, a ſecond Ridge is ſtretched to the Niche. Between the two Ridges the *Glutæus medius* has its Origin; and in the Space between the lower Ridge and the *Acetabulum* the *Glutæus minimus* is lodged. On the Outſide of the poſterior ſpinal Proceſſes the *Dorſum* of the *Os Iliûm* is flat and rough, where the *Muſculus pyriformis* riſes. The inferior Extremity of this Bone becomes much thicker than any other Part of it, and is formed into a large Cavity with high Brims, to aſſiſt in compoſing the great *Acetabulum*, which ſhall be conſidered after all the three Bones that conſtitute the *Os innominatum* are deſcribed.

Interior Surface.

The internal Surface of the *Os Iliûm* is concave in its largeſt anterior Part, where the internal Iliac Muſcle has its Origin, and ſome Share of the *Inteſtinum Iliûm* and *Colon* is lodged. From this large Concavity a ſmall Sinuoſity is con-

tinued obliquely forwards, at the Inſide of th
anterior inferior ſpinal Proceſs, where the con
joined *Pſoas* and *iliacus* Muſcles paſs. Th
large Concavity is bounded below by a ſhar
Ridge, which runs from behind forwards; an
being continued with ſuch another Ridge c
the *Os Pubis*, a Line of Partition is drawn be
tween the *Abdomen* and *Pelvis*. All the in
ternal Surface of the *Os Iliûm*, behind thi
Ridge, is very unequal; for the upper Part i
flat, but ſpungy, where the *ſacrolumbalis* an
longiſſimus dorſi riſe. Below this a tranſverſ
Ridge ſtands out, from which Ligaments g
out to the *Os ſacrum*; and immediately below
this Ridge the rough unequal Cavities and Pro
minences are placed, which are exactly ad
apted to thoſe deſcribed on the Side of th
Os ſacrum: And in the ſame manner the ſupe
rior Part of this rough Surface is porous, fo
the firmer Adheſion of the ligamentous cel
lular Subſtance; while the inferior Part i
more ſolid, and covered with a thin cartilagi
nous Skin, for the immoveable Articulatio
of the Bones. Round all this large unequa
Surface Ligaments riſe to be fixed to the *O*
ſacrum, to ſecure more this Conjunction o
theſe Bones.

Medullary Veſſels.

The Paſſages of the medullar
Veſſels are very conſpicuous bot
in the *Dorſum* and *Coſta* of man
Oſſa Iliûm; but in others they are inconſider
able.

Subſtance.

Theſe Bones are thick at their po
ſterior and inferior Parts, but are ge
nerally exceeding thin and compac
at their Middle, where they are expoſed to th

Action

Actions of the *Muſculi glutæi* and *Iliacus internus*, and to the Preſſure of the Bowels contained in the Belly. The Subſtance of the *Oſſa Iliûm* is moſtly cellular, except a thin external Table.

In a Child. In a ripe Child the Spine of the *Os Iliûm* is cartilaginous, and is afterwards joined to the Bone in Form of an *Epiphyſe*, and the large inferior End of this Bone is not completely oſſified.

Os Iſchiûm. *OS ISCHIUM* * is of a very irregular Figure, and is ſituated loweſt of thoſe that compoſe the *Os innominatum*. Its Extent might be marked by a horizontal Line drawn through near the Middle of the *Acetabulum*; for the ſuperior bulbous Part of this Bone forms ſome leſs than the inferior Half of that great Cavity, and the ſmall Leg of it riſes to much the ſame Height on the other Side of the great Hole common to this Bone and the *Os Pubis*. This Bone therefore is about a middle Bulk between the other two Bones.

Proceſs. From the ſuperior thick Part of this *Os Iſchiûm* a ſharp Proceſs ſtands out backwards, from which chiefly the *Muſculus coccygæus Euſtachii*, and ſtrong Ligament that is fixed to the *Os ſacrum* and *Coccygis* riſe; which, with the other Ligaments that are ſtretched between theſe Bones and the *Oſſa innominata*, ſerve as a ſure Defence to the Sides of the *Pelvis*; and particularly the ſciatic Nerve and poſterior crural Veſſels

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* Coxæ, coxendicis, pixis.

are protected by them, while the containe Parts find in them a ſoft but ſtrong Support.

Depreſſions. Immediately below this ſharp pointed Proceſs, which ſome thenc call *ſpinoſus*, a Sinuoſity is forme for the Tendon of the *Muſculus obturator internus* to play on. In a recent Subject thi Pulley is covered with a ligamentous Cartilage, that by two or three ſmall Ridges poin out the Interſtices of the Fibres in the Tendo of this Muſcle. The exterior Surface of th Bone at the Root of this ſpinous Proceſs is hollowed by the *Pyriformis* or *Iliacus externu* Muſcle, and the Print of ſome Part of th *Obturator Externus* may be ſeen at the inferio Part of the Brim of the *Acetabulum*.

Tuber. Below theſe Sinuoſities the great Tuberoſity or Knob on which we ſit i conſpicuous. This, by the Preſſure i ſuffers from the Weight it ſupports, has it Extremity flat and ſmooth, and in a recen Subject is covered with a Cartilage, or tendinous Subſtance rather, according to *Winſlow* (*a*); but its Baſe is rough, to afford a convenient Origin to a great many Muſcles: For the inferior *Gemellus* riſes from the upper Part, th *Quadratus* from the anterior, the largeſt Hea of the *Triceps* from the poſterior, and the *ſeminervoſus*, *ſemimembranoſus*, and long Hea of the *Biceps*, from the inferior Part of thi Tuberoſity; which, as it advances forwards, becomes ſmaller, but is ſtill rough, for the Origin of the *Erector penis*. From this flat Pro-

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(*a*) Expoſition Anatomique du corps humain, traité des Os frais, § 96.

Proceſs the *Os Iſchiûm* turning much ſmaller, and mounting up with a conſiderable Curve, is ſtretched out into its ſmall Leg, the Edge of which is rough and prominent, where the two inferior Heads of the *Triceps* take their Riſe.

Subſtance. The Subſtance of the *Os Iſchiûm* is much the ſame as of the former Bone. It has no immediate Connexion with any other, except with thoſe which with it conſtitute the *Os innominatum* of the ſame Side.

Of an Infant. In an Infant the great thick Part of this Bone is yet in a cartilaginous State; and the ſpinous Proceſs, great Tuberoſity and recurved Leg, are all in the ſame Condition. The *Tuber* is afterwards added in the Manner that other *Epiphyſes* are.

Os Pubis. The *OS PUBIS* *, or Share-bone, is ſituated in the middle anterior and internal Part of the *Os innominatum*. The thick largeſt Part of this Bone is employed in forming the *Acetabulum*; from which becoming much ſmaller, it is ſtretched inwards to its Fellow of the other Side, where again it grows larger, and ſends a ſmall Branch down to join the Extremity of the ſmall Leg of the *Os Iſchiûm*.

Deſcription. On the ſuperior Part of the *Os Pubis* a Ridge runs in a continued Line with ſuch another of the *Os Iliûm*, which divides the *Abdomen* and *Pelvis*. Near each End of this Ridge a ſmall Protuberance appears on the *Os Pubis*, to which the

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* Pectinis, penis, pudibundum, feneſtratum.

duplicated Tendon of the *Muſculus deſcenden abdominis*, commonly called the *Ligamentum Pubis*, is connected at each Extremity, ſo a to leave a Paſſage behind its Middle for th anterior crural Veſſels and Nerves, which make the Bone both hollow and ſmooth in this Place. At the anterior and internal Par of this Concavity a ſmall Ridge riſes, wher the *Muſculus rectus* and *pyramidalis* are inſerted; and from the oppoſite End of the Hollow, another Ridge runs obliquely outward and down, towards the *Acetabulum*, to give Riſe to the *Pectineus*. Immediately below where this Ridge is to take the Turn down, a winding Niche, comprehended in the grea *Foramen*, is formed in the *Os Pubis*, to allow a Paſſage for the poſterior crural Nerve, an Artery and a Vein. The internal Extremity of the *Os Pubis* is rough and unequal, for the firmer Adheſion of the thick ligamentous Cartilage, that connects it to its Fellow of the other Side: And the Proceſs which goes down from that to the *Os Iſchiûm* is broad and rough before, where the *Gracilis* and upper Heads of the *Triceps*, or rather *Quadriceps adductor femoris*, have their Origin.

Subſtance. The Subſtance of the *Os Pubis* is much of kin to that of the two former Bones.

In a Child. Only Part of the large Extremity of this Bone is oſſified, and the whole Leg is cartilaginous in a Child born to the full Time.

Foramen magnum. Betwixt the *Os Iſchiûm* and *Pubis* a very large irregular *Foramen* is left, which, from its Reſemblance to a

Door or Shield, has by ſome been called *Thyroides*. This Hole is all, except the Niche for the poſterior crural Nerve, filled up in a recent Subject with a ſtrong ligamentous Membrane, that adheres very firmly to the Circumference of this Hole: From the Membrane chiefly the two *Obturatores*, external and internal, take their Riſe. The great Deſign of this *Foramen*, beſides rendring the Bone lighter, would appear to be, for allowing a ſtrong enough Origin to the *obturator* Muſcles, and ſufficient Space for lodging their Bellies, that there may be no danger of diſturbing the Functions of the contained *Viſcera* of the *Pelvis* by the Actions of the internal, nor of the external being bruiſed by the Thigh-bone, eſpecially by the leſſer *Trochanter* in the Motions of the Thigh inwards: Both which Inconveniencies muſt have happened, had the *Oſſa innominata* been complete here, and of ſufficient Thickneſs and Strength to ſerve as the fixed Point of theſe Muſcles.

Acetabulum.

In the external Surface of the *Oſſa innominata*, very near the Outſide of the great *Foramen*, a large deep Cavity is formed by all the three Bones conjunctly: For the *Os Pubis* conſtitutes about one Fifth; the *Os Iliûm*, ſomething leſs than two Fifths, and the *Os Iſchiûm*, as much more than two Fifths. The Brims of this Cavity are very high, and are, in a recent Subject, ſtill vaſtly more enlarged by the ligamentous Cartilage, with which theſe Brims are tipped. From this Form of the Cavity it has been called *Acetabulum*; and for a diſtinguiſhing Character, the Name of the Bone that conſtitutes

the largeſt Share of it is added; therefore *A*
tabulum oſſis iſchii * is the Name this Cav
commonly bears. Round the Baſe of the *S*
percilia the Bone is rough and unequal, whe
the circular Ligament of the Articulation
fixed. The Brims at the ſuperior and bac
Circumference of the *Acetabulum* are mu
larger and higher than any where elſe; whi
is very neceſſary, to prevent the Head of t
Femur from ſlipping out of its Cavity at t
Place, where the whole Weight of the Bo
bears upon it, and conſequently would othe
wiſe be conſtantly in danger of thruſting it ou
As theſe Brims are extended down and fo
wards, they become leſs; and at their intern
inferior Part a Breach is made in them, at t
Side of the great *Foramen*. From the one Si
of which Breach to the other, a Ligament
placed in the recent Subject; under which
gain a large Hole is left, which contains a fa
ty cellular Subſtance and Veſſels. The Re
ſon of which Appearance has afforded Ma
ter of Debate. To me it ſeems evidently co
trived for allowing a larger Motion to t
Thigh inwards: For if the bony Brims ha
been here continued, the Neck of the *Fem*
muſt have ſtruck upon them when the Thig
are croſſed, which, in a large ſtrong Moti
this Way, would have endangered the Nec
of the one Bone, or Brim of the other. The
the Veſſels which are diſtributed to the Joi
may ſafely enter at the Sinuoſity in the Bo
tom of the Breach; which being however la
ger than is neceſſary for that Purpoſe, ſerv
an

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* Coxæ, coxendicis.

another very good Uſe, remarked by *Petit* (a), which is, to allow the large mucaginous Gland of the Joint to eſcape below the Ligament, when the Head of the Thigh-bone is in hazard of preſſing too much upon it in the Motions of the Thigh outwards. Beſides this Difference in the height of the Brims, the *Acetabulum* is otherwiſe unequal: For the inferior internal Part of it is depreſſed below the cartilaginous Surface of the ſuperior Part, and has no ſmooth cartilaginous Surface; into its upper Part, where it is deepeſt, and of a ſemilunar Form, the Ligament of the Thigh-bone, which is commonly, tho' improperly, called the *round* one, is inſerted; while in its more ſuperficial inferior Part the large mucilaginous Gland of this Joint is lodged. The largeſt Share of this ſeparate Depreſſion is formed in the *Os Iſchiûm*.

Of Children.

From what has been ſaid of the Condition of the three Bones compoſing this *Acetabulum* in new born Children, it muſt be evident that a conſiderable Part of this Cavity is cartilaginous in ſuch.

Connexion.

The *Oſſa innominata* thus formed of three Bones on each Side intimately united in Adults, are at their poſterior Part firmly conjoined to each Side of the *Os ſacrum* by a ſort of Suture, with a very thin intervening Cartilage, and at their anterior Part to each other by *Synchondroſis*, while their *Acetabula* afford a fixed Socket for the Thigh-bones to play in. Wherefore one would be-

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(a) Memoires de l'Acad des Sciences. 1722.

believe theſe Bones would not partake of
Motion, except what they have in comm
with the whole Trunk of the Body, or w
the *Os ſacrum*; and that ſuch a prodigi
Force as would be ſufficient to make them
parate, would endanger the Per
Phænomena. to whom it was applied. Ho
ever it has been a controver
Queſtion, ſtrenuouſly debated among Ana
miſts, Whether the *Oſſa Iliûm* ſeparate fr
the *ſacrum*, or the *Oſſa Pubis* from one an
ther, in time of Child-birth? After the Ex
riments and Obſervations related by *Spige*
(*a*), *Riolan* (*b*), *Diemerbroek* (*c*) and oth
one cannot well deny that ſuch a Thing m
and does happen; but then we ſhould, w
Morgagni (*d*), beware of regarding this a
conſtant *Phænomenon*, which is only found
a few extroardinary Caſes. This I can fr
my own Experience aver, that tho' I have f
quently applied my Fingers to the Conjun
on of the *Oſſa Pubis* in very laborious Birt
on purpoſe to ſatisfy myſelf in this Matt
yet I never could be ſenſible of ſuch a ſepa
tion or Removal of the Bones from each
ther. And as I ſaid formerly it is moſt r
ſonable to think that very great Inconveni
cies would attend the Separation of the *O*
Iliûm from the *Os ſacrum*. I have ſeen ſo
Women of a delicate tender Make, who
ter ſevere Child-bearing complained of P
and Weakneſs, and as they thought of a ji
i

(*a*) Lib. 2. cap. 34.
(*b*) Anthropograph. lib. 6. cap. 12.
(*c*) Anat. lib. 9. cap. 16.
(*d*) Adverſar. 2. animad. 15.

g Motion in this Place, which I could not
e the leaſt ſenſible of with my Fingers. For
veral Months they could neither ſit nor ſtand
ithout Pain, and had a Weakneſs here much
nger.

We may now conceive what a large Cavi-
the *Pelvis* is, ſtrongly fenced by Bones for
e Safety and Support of the contained *Vi-*
era, and for the Origin and Inſertion of a
eat Number of Muſcles; while at the ſame
me there is ſuch a Diſtance left between its
ones at the inferior Part, as may allow ſuf-
cient Space for the large Excretories, the
eſica urinaria, *Inteſtinum rectum*, and in Wo-
en the *Uterus*, to diſcharge themſelves.

THORAX.

The *THORAX* *, or Cheſt is
e only Part of the Trunk of
e Body now undeſcribed. It
aches from below the Neck to the Belly; and
y means of the Bones that guard it, is form-
d into a large Cavity: The Figure of which is
mewhat conoidal; but its ſuperior ſmaller
xtremity is not finiſhed, being left open for
e Paſſage of the Wind-pipe, Gullet and large
lood-veſſels; and its inferior Extremity or the
aſe is unguarded with Bones, and is ſhorter be-
re than behind; ſo that, to carry on our Com-
ariſon, it appears like an oblique Section of
e Conoid. Beſides which we ought alſo to
mark, with *Albinus* (a), that the lower Part of
is Cavity is narrower than ſome Way above;
nd that the Middle of the poſterior Part of the
avity is conſiderably diminiſhed by the Ribs
turn-

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* Pectus, caſſum.

(a) De Oſſib. § 169.

turning forwards, and by the Bodies of *Vertebræ* of the Back being prominent wit the *Thorax*.

What Bones composed of. The Bones which form the *T* *rax* are the twelve dorſal *Verteb* behind, the Ribs on the Sides, a the *Sternum* before.

Vertebræ. The *Vertebræ* have already be deſcribed as Part of the Spine, a therefore are now to be paſſed.

Ribs. The *RIBS*, or *Coſtæ* *, (as if th were *Cuſtodes* or Guards to theſe pri cipal Organs of the animal Machi the Heart and Lungs) are the long crook Bones placed at the Side of the Cheſt in oblique Direction downwards in reſpect the Back-bone. Their Number is genera twelve on each Side, tho' frequently eleven thirteen have been found. I never ſaw few or more than the ordinary Number; but the Skeleton of a Boy about eight Years o now in my Poſſeſſion, the fourth and fi Ribs of the left Side are grown together their Roots for near an Inch, and afterwa dividing, have the ſame Appearance as t Ribs of the oppoſite Side, which are natura formed.

The Ribs are all convex externally, a concave internally, where they are alſo ma ſmooth by the Action of the contained Par which on this Account are in no Danger being hurt by them. The Extremities of t Ribs next the *Vertebræ* are rounder than aft theſe Bones have advanced forwards, wh th hey become flatter and broader, and have a ſuperior and inferior Edge, each of which is made rough by the Action of the *intercoſtal* Muſcles inſerted into them. Theſe Muſcles, being all of near equal Force, and equally ſtretched in the Interſtices of the Ribs, will reſiſt theſe Bones having their broken Ends, in a Fracture, removed far out of their natural Place to interrupt the Motion of the vital Organs. The upper Edge of the Ribs is more obtuſe and rounded than the inferior, which is depreſſed on its internal Side by a long *Foſſa*, for lodging the intercoſtal Veſſels and Nerves. This Channel is not obſervable however at either Extremity of the Ribs; for at the poſterior or Root, the Veſſels have not yet reached the Ribs, and at the anterior Extremity they are ſplit away into Branches, to ſerve the Parts between the Ribs, which plainly teaches Surgeons, how much ſafer it is to perform the Operation of the *Empyema* towards the Sides of the *Thorax*, than either near the Back or Breaſt, tho' there were no other Reaſons to determine them in the Choice of the Place where this Operation ſhould be performed.

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* Πλευραὶ, ϖεριςέρνα, σπάθαι.

At the poſterior Extremity * of each *Rib*, a little Head is formed, which is divided by a middle Ridge into two plain or hollow Surfaces, the inferior of which is the broadeſt and deepeſt. The two Plains are joined to the Bodies of two different *Vertebræ*, and the Ridge forces it ſelf into the intervening Cartilage. A little Way from this Head, we find on the external Surface a ſmall Cavity, where muci-

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* Κώπιον, Remulus,

laginous Glands are lodged; and round th Head the Bone appears ſpungy, where the ci cular Ligament of the Articulation is fixe Immediately beyond this a flatned Tubercl riſes with a ſmall Cavity at and Roughne round the Root of it, for the Articulation o the Rib with the tranſverſe Proceſs of th loweſt of the two *Vertebræ*, with the Bodies o which the Head of the Rib is joined. Ad vancing ſtill a little further on this externa Surface, we obſerve another ſmaller Tubercl into which the Tendons of the *Longiſſimu dorſi* are inſerted. Soon after this the Rib make a conſiderable Curve, which ſome cal their Angle; into it the *Sacro-lumbalis* is inſert ed. Then the Rib begins to turn broad, an continues ſo to its anterior Extremity †, whic is hollowed and ſpungy, for the Reception o and firm Coalition with the Cartilage tha runs thence to be inſerted into the *Sternum* or to be joined with ſome other Cartilages In Adults, generally the Cavity at this anterio Extremity of the Ribs is ſmooth and poliſhe on its Surface, by which the Articulation o the Cartilage with it would ſeem deſigned fo Motion, which however is not allowed.

Subſtance. The Subſtance of the Ribs is ſpongy, cellular, and only covered wit a very thin external lamellated Surface, which is thicker and ſtronger near the *Vertebræ* than at the anterior Extremity.

Cartilages. To each Rib a long broad and ſtrong Cartilage is fixed, and reaches thence to the *Sternum*, or is adjoining

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† Πλάτη, Palmula.

ing to the one next it. This Courſe however of theirs, is not in a ſtreight Line with the Rib, for generally the Cartilages make a conſiderable Curve, the concave Part of which is upwards; therefore, at their Inſertion into the *Sternum*, make an obtuſe Angle above, and acute one below. Theſe Cartilages are of ſuch a Length, as never to allow the Ribs to come to a right Angle with the Spine, but keep them ſituated ſo obliquely as to make a very conſiderable obtuſe Angle above, 'till once a Force Superior to the Elaſticity of the Cartilages is applied. Theſe Cartilages, as all others, are firmer and harder internally, than they are on their external Surface; and ſometimes in old People, according to *Veſalius* (a), all their middle Subſtance becomes bony, while a thin cartilaginous *Lamella* appears externally, tho' the Oſſification begins much oftner at the external Surface. The greateſt alternate Motions of the Cartilages being made at their great Curvature, that Part, as *Havers* (b) has remarked, remains frequently cartilaginous after all the reſt is oſſified.

Articulation.

The Ribs then are articulated at each Extremity, of which the poſterior is doubly joined to the *Vertebræ*, for the Head is received into the Cavities of two Bodies of the *Vertebræ*, by what I called the ſecond Species of *Ginglymus*; and the larger Tubercle is articulated to the tranſverſe Proceſs of the inferior *Vertebra*, by what is commonly called *Arthrodia*, which I comprehended

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(a) Lib. 1. cap. 19.

(b) Oſteolog. nov. Diſc. 5.

prehended 'under the *Enarthroſis*; and if w were to conſider conjunctly both theſe Art culations of any Rib with the *Vertebræ*, would come under the third Species of *Gingl mus*. As ſoon as one conſiders this doub Articulation, he muſt immediately ſee, th no other Motion can here be allowed than u and down, ſince the tranſverſe Proceſſes hinder it to be thruſt back; the Reſiſtance on th other Side of the *Sternum*, prevents the Rib coming forward; and each of the two Join with the other Parts attached, oppoſe the turning round: But then 'tis likewiſe as ev dent, that even the Motion upwards an downwards, can be but ſmall in any one Ri at the Articulation it ſelf, tho' it may be ver conſpicuous at the anterior Extremity, whic moves in a Circle, whoſe *Radius* is the Lengt of the Rib. If at the ſame time, we conſide how obliquely the Ribs are ſituated in reſpect t the *Vertebræ*, we muſt be convinced, that th Ribs cannot be raiſed without removing farther from the Back-bone; and as a conſiderable Reſiſtance is made by the *Sternum* to thei anterior Extremities, theſe Bones muſt, i moving upwards, be alſo turned outwards, a *Winſlow* (a) has proved. The anterior En of the Ribs has no proper movable Articulation, except ſo far as the Cartilages betwee the *Sternum* and Ribs will yield, on whic Account and becauſe of the Reſiſtance, ſuc Ribs as perform large Motions under theſ Diſadvantages, are commonly twiſted towards their anterior Extremities.

(a) Memoires de l'Acad. des Sciences 1720.

Hitherto I have laid down the Structure and Connexion which moſt of the Ribs enjoy, as belonging to all of them; but muſt now conſider the Specialities wherein any of them, either collectively or ſingly, may differ from the general Deſcription given, or from each other. *Diſtinguiſhed.*

In viewing the Ribs from above downwards, their Figure is ſtill ſtreighter, the uppermoſt being the moſt crooked of any. Their Obliquity in reſpect of the Spine increaſes as they deſcend; ſo that tho' the Diſtance of their poſterior Extremities from each other are very little different, yet at their anterior Extremities the Diſtances between the inferior ones muſt increaſe. In conſequence too of this increaſed Obliquity of the inferior Ribs, each of the Cartilages of the inferior Ribs makes a greater Curve in its Progreſs from the Rib towards the *Sternum*, and the Tubercles, that are articulated to the tranſverſe Proceſſes of the *Vertebræ*, have their ſmooth Surface gradually facing more upwards. The Ribs becoming thus more oblique, while the *Sternum* advances forward in its Deſcent, make the Diſtance between the *Sternum* and the anterior Extremity of the lower Ribs greater than between the *Sternum* and the ſuperior Ribs, conſequently the Cartilages of thoſe Ribs that are joined to the Breaſt-bone are longer in the lower ones. Theſe Cartilages are placed nearer to each other as the Ribs deſcend, which aſſiſts to oblige the Curvature of the Cartilages to be greater.

The Length of the Ribs increaſes from the firſt or uppermoſt Rib, as far down as the ſeventh, and from that to the twelfth as gradually diminiſhes. The ſuperior of the tw plain, or rather hollow Surfaces, by whic the Ribs are articulated to the Bodies of th *Vertebræ*, gradually increaſes from the firſt t the fourth Rib, and is diminiſhed after that i each lower Rib; and the Diſtance of the Angles from the Heads always increaſes a they deſcend to the ninth. This is remarke by *Winſlow* (a).

Divided. The Ribs are commonly divide into True and Falſe.

True Ribs. The *True* * *Coſtæ* are the ſeven ſuperior of each Side, whoſe Cartilages are all gradually longer a the Ribs deſcend, and are joined to the Breaſt-bone; ſo that being preſſed conſtantly between two Bones, they are flatned at both Extremities, and are thicker, harder, and more liable to oſſify than the other Cartilages, that are not ſubject to ſo much Preſſure. Theſe Ribs include the Heart and Lungs, and therefore are the proper or true *Cuſtodes* of Life.

Falſe Ribs. The Five inferior of each Side are the *Falſe*, or *BASTARD* *, whoſe Cartilages do not reach the *Sternum*; and therefore, wanting that Reſiſtance at their anterior Extremity, are there pointed; and for the ſame Reaſon being leſs preſſed, the Subſtance of theſe Cartilages is ſofter. The Cartilages of theſe *falſe Ribs* are

ſhorter

(a) Expoſition Anatomique des Os ſecs § 643.

* Γνήσιαι, Germanæ, legitimæ.

* Μαλθάκαι, χονδρωδεῖς, ἄκανθαι, κλίνες, Adulterinæ, ſpuriæ, illegitimæ.

horter as the Ribs deſcend. To all theſe five
Ribs the circular Edge of the *Diaphragm* is
onnected; and its Fibres, inſtead of being
tretched immediately tranſverſely, and ſo run-
ing perpendicular to the Ribs, are preſſed ſo
s to be often, eſpecially in Exſpiration, paral-
o the Plane in which the Ribs ly; nay, one
nay judge by the Attachments which theſe
ibres have ſo frequently to the Sides of the
horax, a conſiderable Way above where
neir Extremities are inſerted into the Ribs,
nd by the Situation of the *Viſcera*, always to
e obſerved in a dead Subject laid ſupine, that
nere is conſtantly a large Concavity formed
n each Side by the *Diaphragm* within theſe
aſtard Ribs, in which the Stomach, Liver,
pleen, *&c.* are contained, which being only
eckoned among the *Viſcera naturalia*, have
ccaſioned the Name of *Baſtard Cuſtodes* to
heſe Bones.

Hence we may eaſily underſtand the Juſtice
f *Hippocrates*'s *(a)* Rule in ſimple Fractures
f the falſe Ribs, without a Fever, to keep
ie Stomach moderately filled with Food, leſt
ie pendulous Ribs falling inwards, ſhould
ereby increaſe the Pain, Cough, *&c.* The
ruth of this Obſervation *Paré* *(b)* after his
ng Experience confirms; but it is now-a-
ays much forgot, or entirely neglected.

The uppermoſt or firſt Rib has ſeveral
roper Specialities; ſome of them contra- 1.
ctory to any Character yet delivered of
e Ribs; for the Figure of it is much more
curve

(*a*) De Articulo.
(*b*) Lib. 15. cap. 11.

curve than any of the reſt whence the Nam
of ἀντίϛροφαι, *Retortæ*, has been applied to
and the ſecond. The Situation of the firſt
ſuch, that the flat Sides are ſuperior and inf
rior, while the Edges are anterior and poſt
rior, or near ſo; therefore ſufficient Space
left above it for the Subclavian Veſſels an
Muſcle; and the broad concave Surface of
is oppoſed to the Lungs: But then in conſ
quence of this Situation, the Channel for th
intercoſtal Veſſels is not to be found, and th
Edges are differently formed from all the oth
except the ſecond, the lower one being roun
ed and the other ſharp. The Head of this R
is not divided into two plain Surfaces by
middle Ridge, becauſe it is only articulate
with the firſt *Vertebra* of the *Thorax*. Th
Cartilage at the anterior Extremity of the fir
Coſta, is oſſified in Adults, and is united
the *Sternum* at right Angles. Frequently th
firſt Rib has a Ridge riſing near the Middle
its poſterior Edge, where one of the Heads
the *Scalenus* Muſcle riſes; and nearer to th
anterior Extremity, it is flatned, or ſometim
depreſſed by the Clavicle.

3. 4. The third and fourth Ribs have bee
diſtinguiſhed by the Name of ϛέρεαι, *S*
5. 6. *lidæ*; the fifth and ſixth, by the Appe
7. 8. pellation of ϛερνιτιδες, *Pectorales*; th
ſeventh and eight are called ἐσπασύο
Diſtractæ. But it muſt be acknowledge
there is no great Occaſion or good Reaſon f
theſe Names, ſince theſe Ribs ſcarce can clai
any Thing particular, but what comes und
the general Deſcription, or belongs to mo
than two of them. The fifth, ſixth, ſeventh

or rather the ſixth, ſeventh, eighth, and ſometimes fifth, ſixth, ſeventh, eighth, ninth Ribs have their Cartilages at leaſt contiguous; and frequently they are conjoined by croſs Cartilages; and moſt commonly the Cartilages of the eighth, ninth, tenth are connected to the former, and to each other, by firm Ligaments.

11. The eleventh and ſometimes the tenth Rib, has no Tubercle for its Articulation with the tranſverſe Proceſs of the *Vertebra*, to which it is only looſely fixed by a Ligament. The *Foſſa* in its inferior Edge, is not ſo deep as in the ſuperior Ribs, becauſe the Veſſels run more towards the Interſtice between the Ribs. Its anterior Extremity is ſmaller than its Body, and its ſhort ſmall Cartilage is but looſely connected to the Cartilage of the Rib above.

12. The twelfth Rib is the ſhorteſt and ſtreighteſt: The Head of it is only articulated with the laſt *Vertebra* of the *Thorax*, therefore is not divided into two Surfaces. This Rib is not joined to the tranſverſe Proceſs of the *Vertebra*, and therefore has no Tubercle, being often pulled neceſſarily inwards by the Diaphragm, which an Articulation with the tranſverſe Proceſs would not have allowed. The *Foſſa* is not found at its under Edge, becauſe the Veſſels run below it. The anterior Extremity of this laſt Rib is ſmaller than its Middle, and has only a very ſmall pointed Cartilage fixed to it. To the whole Length of this Rib internally the Diaphragm is connected.

The Motion and Uſes of the Ribs ſhall be more particularly treated of, after the Deſcription of the following Bone.

Of Infants. The Ribs are all complete in new born Child, only their Cartilages are proportionally longer tha in an adult Perſon.

Here I cannot help remarking the wiſe Providence of our Creator, in preſerving us fro periſhing as ſoon as we come into the World The Extremities by which the Bones of th Limbs are articulated remain in a cartilaginous State after Birth, and are many Years before they are intirely united to the main Bod of their ſeveral Bones; whereas the Condyle of the occipital Bone, and of the lower Jaw and the Heads and Tubercles of the Ribs, ar true original Proceſſes and oſſified befor Birth, and therefore the Weight of the larg Head is firmly ſupported, the Actions of Sucking, ſwallowing, Reſpiration, *&c.* which ar indiſpenſably neceſſary for us as ſoon as w come into the World, are performed withou any Danger of the Parts of the Bones that ar moſt preſſed on in theſe Motions being ſeparated; whereas, had theſe Proceſſes of th Head, Jaw, and Ribs been Epiphyſes at Birth Children muſt have been expoſed to an evide Danger of dying by ſuch a Separation, who immediate Conſequences would be the Compreſſion of the Beginning of the *Medulla ſpinalis*, or want of Food or of Reſpiration.

Sternum. The *STERNUM* *, or Breaſt bone, is the broad flat Bone, o Pile of Bones at the anterior Part th

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* Στῆθος, Os Pectoris, enſiforme, ſcutum cordis.

e *Thorax.* The Number of Bones this
ould be divided into, has occaſioned De-
ates among Anatomiſts, who have conſidered
in young Subjects of different Ages. In A-
ults of a middle Age, it is compoſed of three
ones, which eaſily ſeparate after the Carti-
ges connecting them are deſtroyed: Fre-
uently the two lower Bones are found inti-
ately united, and very often in old People,
e *Sternum* is a continued bony Subſtance
om one End to the other, tho', on the Surface
f it, we may ſtill obſerve two, ſometimes
ree tranſverſe Lines, which mark out the for-
er Diviſions.

When we conſider the *Sternum* as one Bone,
e find it broadeſt and thickeſt above, and be-
oming ſmaller as it deſcends. The internal
poſterior Surface of this Bone is ſomewhat
ollowed for enlarging the *Thorax*, but the
onvexity on the external Surface, is not ſo
onſpicuous, becauſe the Sides are preſſed
twards by the true Ribs, the round Heads of
hoſe Cartilages are received into ſeven ſmooth
ts formed in each Side of the *Sternum*, and
e kept firm there by ſtrong Ligaments, which
the external Surface have a particular radi-
ed Texture (a): Frequently the cartilaginous
bres thruſt themſelves into the bony Sub-
nce of the *Sternum*, and are joined by a
rt of Suture. The Pits at the ſuperior Part
the *Sternum*, are at the greateſt Diſtance one
om another, and as they deſcend are nearer,
that the two loweſt are contiguous.

The

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a) Ruyſch Catalog. Rar. Fig. 9.

Subſtance. The Subſtance of the Breaſt-bo is cellular, with a very thin extern Plate, eſpecially on its internal Su face, where, with *Jac. Sylvius* (a) we may fr quently obſerve rather a cartilaginous Cru ſpread over it. On both Surfaces howeve, ſtrong ligamentous Membrane is cloſely bo ced, and the Cells of this Bone are ſo ſma that a conſiderable Quantity of oſſeous Fib muſt be employed in the Compoſition of Whence, with the Defence the Muſcles g it, and the movable Support it has from flexible Cartilages, it is ſufficiently ſecu from being broke by any ſmall external Forc For it is ſtrong by its Quantity of Bone; Parts are kept together by the Ligaments, it yields enough to elude conſiderably the V lence offered.

So far in general may be ſaid of this Bo but to deſcend to its particular Deſcription, us examine the three Bones, which, accord to the common Accounts, go to the Compo tion of it in an Adult.

Firſt Bone. The firſt, all agree, is ſomew of the Figure of a Heart, as it commonly painted, only it do not terminate in a ſharp Point. This is uppermoſt thickeſt Part of the *Sternum*.

The ſuperior Middle Part of this firſt Bo where it is thickeſt, is hollowed, to ma Place for the *Trachea arteria*, tho' this Cavi is principally formed by the Clavicles preſ on one Side, and by the *Sternomaſtoidei* M

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(a) In Galen de oſſibus, cap. 12.

* Σφαγὴ, Jugulum, Furcula ſuperior.

les pulling the Subſtance of the Bone above, to oth which it yields while it is ſoft, and therefore raiſed here into two Tubercles, while the iddle is not protruded by ſuch Powers. On e Outſide of each Tubercle, there is an ob- ong Cavity, that, in viewing it tranſverſely rom before backwards, appears a little con- ex: Into theſe *Glenæ* the Extremities of the lavicles are received. Immediately below eſe, the Sides of this Bone begin to turn thin- er, and in each a ſuperficial Cavity or a rough urface is to be ſeen, where the firſt Ribs are eceived or conjoined to the *Sternum*. In the ide of the under Extremity of this firſt Bone e Half of the Pit for the ſecond Rib on each ide is formed. The ſuperior Part of the po- terior Surface is covered with a ſtrong Liga- ment deſcribed by *Weitbreicht (a)* and *Win- low (b)*, which ſecures the Clavicles, and is fterwards to be more particularly taken no- ice of.

Second Bone.

The ſecond or middle Diviſion of this Bone, is much longer, nar- ower, and thinner than the firſt, ut, excepting that it is a little narrow above, s pretty equal all over as to its Dimenſions of Breadth or Thickneſs. In the Sides of it are complete Pits for the third, fourth, fifth and ſixth Ribs, and half of the Pits for the ſecond and ſeventh are formed in it. Near its Middle an unoſſified Part of the Bone is ſometimes found, which freed of the ligamentous Membrane or Cartilage that fills it, is deſcribed as a

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(a) Act. Petropolit. Tom. iv, p. 255.
(b) Des Os frais, § 248.

Hole; and in this Place, for the moſt Part, w may obſerve a tranſverſe Line running, tha has made Authors divide this Bone into two When the Cartilage between this and the fir Bone is not oſſified, a manifeſt enough Motion of this upon the firſt may be obſerved in Re ſpiration, or in raiſing the *Sternum* by pullin the Ribs upwards in a recent Subject.

Cartilago xiphoides.

The third Bone is by much the leaſt, and has only one Half of the Pit for the ſeventh Rib formed in it; wherefore it might be reckoned only an *Appendix* of the *Sternum*. In young Subjects it is always cartilaginous, and is better known by the Name of *Cartilago xiphoides* or *enſiformis* *, than any other, tho' the Ancients often called the whole *Sternum*, *Enſiforme*, comparing the two firſt Bones to the Handle, and this *Appendix* to the Blade of a Sword. This Bone is ſeldom of the ſame Figure, Magnitude or Situation in any two Subjects; for ſometimes it is a plain triangular Bone, with one of the Angles below, and perpendicular to the Middle of the ſuperior Side, by which it is connected to the ſecond Bone. Other Times the Point is turned to one Side or other, or obliquely forwards or backwards. Frequently it is all of near an equal Breadth, and in ſeveral Subjects, the Extremity of it is bifurcated; whence ſome Writers give it the Name of *Furcella* or *Furcula inferior*; or elſe it is perforated in the Middle. In the greateſt Number of Adults it is oſſified;

and

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* Clypealis, gladialis, mucronata, malum granatum, ſcutum ſtomachi, epiglottalis, cultralis, Medium Furculæ inferioris, ſcutiformis, enſiculata.

nd tipped with a Cartilage; in ſome it is Half
r whole Cartilage.

So many different Ways this ſmall
Bone may be conſtituted, without any
nconvenience: But then ſome of
eſe Poſitions may be ſo directed, as to bring
n a great Train of ill Conſequences; particu-
arly, when the lower Extremity is entirely oſ-
fied, and is too much turned outwards or in-
vards, or when the Conjunction of this *Ap-*
endix with the ſecond Bone is too weak.
olfincius (a) relates the Hiſtory of an old
Man, who could not bend his Body forwards,
vithout a violent pungent Pain from the Oſſi-
cation and ſharp Point of this Bone. *Paaw*
b) aſſures us, he has ſeen ſeveral Inſtances of
difficult Breathing from the ſame Cauſe, and
numerates ſeveral Diſeaſes, ſuch as a *Pthiſis*
ulmonalis, *Obſtructions of the Spleen*, *Liver*,
r *Meſentery*, which may depend on too great a
Relaxation of this Cartilage; and ſometimes
is Relaxation may only be a Conſequence of
eſe Diſeaſes. *Borrichius* (c) confirms all
is by ſome Examples. But not to be tedious
relating ſuch Hiſtories, I ſhall refer you to
onetus (d), who has ſeveral Examples col-
cted, and will direct you to the Writers on
is Subject, which in the laſt Century em-
oyed ſeveral Pens, tho' it is now much ne-
ected. This Neglect is the more ſurpriſing,
nce the Connexion of the Diaphragm here,

Diſeaſes.

U 2

(a) Diſſert. Anat. lib. 2. cap. 41.
(b) De Oſſibus, part 1. cap. 3. & part. 3. cap. 3.
(c) Act. Hafn. Vol. 5. Obſ. 79.
(d) Sepulchret. Anat. tom. 2. lib. 3. Sect. 5. Append. obſerv. 8. & ibid. Sect. 7. Obſ. 19.

the Situation of the large Lobe of the Liver an of the Stomach, and the conſtant Preſſure an rubbing of our Cloaths on this Part, leads u naturally to conſider the Effects of a fault Structure and Situation of this Bone.

Connected.

The *Sternum* is joined by *Synchondroſis* to the ſeven ſuperior Ribs, unleſs when the firſt coaleſces with in an intimate Union of Subſtance; and it i articulated with the the *Clavicles* by a *Ginglymus* of the ſecond Kind.

Of Children.

The *Sternum* moſt frequently ha four round ſmall Bones, ſurrounded with Cartilage, in Childre born to the full Time; the uppermoſt of theſ which is the firſt Bone, being the largeſt b much. Two or three other very ſmall bon Points are likewiſe to be ſeen in ſeveral Chi dren. The Number of Bones increaſes for ſom Years, and then diminiſhes, but uncertainl till they are at laſt united into thoſe above deſcribed of an Adult.

Uſes.

The Uſes of this Bone are, to affor Origin and Inſertion to ſeveral Muſcles to ſuſtain the *Mediaſtinum*; to defen the vital Organs, the Heart and Lungs at th anterior Part; and laſtly, by ſerving as a movable *Fulcrum* of the Ribs, to aſſiſt conſider bly in Reſpiration: Which Action, ſo far as depends on the Motion of the Bones, we a now at Liberty to explain.

When then the Ribs that are connected b their Cartilages to the *Sternum*, or to the Ca tilages of the true Ribs, are acted upon by th intercoſtal Muſcles, they muſt all be pull from the oblique Poſition their Cartilages ke them in, nearer to right Angles with the *Vertebræ* and *Sternum*, becauſe the firſt or uppermoſt Rib is by much the moſt fixed of any; and their large arched middle Part, as was remarked in the Deſcription of the Ribs, will be turned outwards, to increaſe the Diſtance between the Sides of the *Thorax*, or to widen this Cavity; while by raiſing the Ribs nearer to right Angles, the Diſtance between the parallel Lines that comprehend their Extremities is increaſed: And as the *Vertebræ* hinder the Ribs to recede back, this whole Increaſe muſt be by the Advance of theſe Extremities forwards. Hence the intermediate *Fulcrum*, the *Sternum*, preſſed ſtrongly on both Sides, muſt be puſhed forwards, and that, at its ſeveral Parts, in proportion to the Length and Motion of its Supporters the Ribs; that is, moſt at its inferior Extremity; which, thus forced forwards, will, with the Cartilages now in the ſame Manner acted upon, draw the *Diaphragm* connected to them; conſequently ſo far ſtretch it, and bring it nearer to a Plain: And the ſame Power that raiſes this Bone and Cartilages, will ſufficiently fix them, ſo as they may reſiſt the Action of that Muſcle, whoſe Fibres contract at the ſame time, and thruſt the *Viſcera* of the *Abdomen* downwards. The arched Part of the Ribs being thus moved outwards, the anterior Extremity of the Ribs and the *Sternum* being advanced forwards, and the Diaphragm being brought nearer to a plain Surface, inſtead of being greatly convex on each Side within each Cavity of the *Thorax*, 'tis evident how conſiderably the Cavity, of which the nine or ten ſuperior of theſe Bones are the Sides, muſt be

widned,

widned, and made deeper and longer. Bu while this is doing in the ſuperior Ribs, the inferior, whoſe Cartilages are not conjoined perform a very different Office, tho' it conſpires to the ſame Intention, the Enlargemen of the *Thorax*: For as they have no fixed Poin to which their anterior Extremity is faſtned and have the *Diaphragm* inſerted into them a the Place where that Muſcle runs pretty ſtraight upwards from its Origin at the *Vertebræ*; therefore theſe Ribs being expoſed on the one Side to the direct Action of this ſtrong Muſcle, and of the Muſcles of the *Abdomen*, which at this time are reſiſting the ſtretching Force of the Bowels, and are drawing theſe Bones down, while the intercoſtal Muſcles are pulling them upwards, the Effect of either of theſe Powers, which are Antagoniſts to each other, is very little as to moving the Ribs either up or down. But the Muſcles of the *Abdomen* being puſhed at this Time outwards by the *Viſcera*, carry theſe Ribs along with them; and thus the *Thorax* is not only not allowed to be ſhortned, but is really widned at its lower Part, to aſſiſt in making ſufficient Space for the due Diſtenſion of the Lungs.

As ſoon as the Action of theſe ſeveral Muſcles ceaſes, the elaſtic Cartilages extending themſelves to their natural Situation, depreſs the ſuperior Ribs, and the *Sternum* ſubſides; the *Diaphragm* is thruſt up by the *Viſcera abdominalia*, and raiſes the inferior Ribs with it; in which it is aſſiſted by any Action their intercoſtal Muſcles have; while the oblique and tranſverſe Muſcles of the Belly ſerve to raw theſe Ribs inwards at the ſame time: rom all which the Cavity of the Breaſt is iminiſhed in all its Dimenſions. Thus hen the *Thorax* is made wider, deeper and onger, and is again ſtraitned and ſhortned in Manner not generally ſo well underſtood.

The laſt Part of the Skeleton, *viz.* the *Ex-remities* [*], are only left undeſcribed. Theſe re commonly divided into *ſuperior* and *infe-ior*.

Of the ſuperior Extremities.

SUPERIOR EXTREMITIES.

AUTHORS here are much divided, how many Bones ould be comprehended under this Deſigna-on; and have, according to their different entiments, ranged the ſame Bones under dif-erent Titles. To me it ſeems moſt natural, at all theſe Parts which are immediately oncerned in and ſubſervient to the Motions ere performed, without being neceſſary to the *Thorax*, from which theſe ſuperior Extremities epend; all ſuch, I ſay, may and ſhould be eckoned to belong to theſe uſeful Organs: And therefore I ſhall divide each ſuperior Ex-emity into the *Shoulder*, *Arm*, *Fore-arm* and *Hand*.

SHOULDER.

The *SHOULDER* conſiſts of he *Clavicle* and *Scapula*.

Clavicula.

CLAVICULA, or Collar-one [†], is the long ſmall crooked

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[*] Κῶλα, γυῖα, ἐκφύαδες, Enata, adnata, explantata membra, artus.

[†] Os jugulare, jugulum, furcula, ligula, clavis, hume-us quibuſdam.

Bone, in Figure like an *Italic ſ*, placed a
moſt horizontally between the upper later
Part of the *Sternum*, and what is common
called the Top of the Shoulder. which as
Clavis or Beam it bears off from the Trunk
the Body.

Internal Extremity.

The *Clavicle*, as well as oth
long round Bones, is larger at i
two Extremities than in the Middl
The internal Extremity *, I mean that next t
the *Sternum*, is triangular: The Sides conſti
tuting the poſterior Angle are conſiderably pro
duced, ſo as to form a ſharp Ridge, and th
Side oppoſite to that is ſomewhat rounde
The Middle of this protuberant Extremity
as irregularly hollowed as the Cavity in th
Sternum for receiving it is raiſed; but in a re
cent Subject, the irregular Concavities of bo
are ſupplied by a movable Cartilage, whic
is much more cloſely connected by Lig
ments to the Circumference of the Articul
tion, than thoſe of the lower Jaw.

Body.

From this internal Extremity, th
Clavicle, for about two Fifths of i
Length, is bended obliquely forwar
and downwards. On the ſuperior and ant
rior Part of this Curvature a ſmall Ridge
ſeen with a plain rough Surface before i
whence the *Muſculus ſterno-hyoideus* and *ſte*
no-maſtoideus have in part their Origin. Ne
the inferior Angle a ſmall plain Surface
often to be remarked, where the firſt Rib ar
this Bone, according to *Dionis*'s (a) Obſerv
tic

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* Παρασφάγις.

(a) Sixieme demonſtr. des Os.

on, are contiguous. From this a rough plain urface is extended along this anterior Con- exity, where the pectoral Muſcle has Part of s Origin; and behind, the Bone is made flat nd rough, by the Inſertion of the larger Share f the ſubclavian Muſcle. After the Clavicle egins to form the poſterior Convexity, it is retty round, but ſoon after becomes broad nd flat; which Shape it retains to the external Extremity. Along the external Concavity a ough Sinuoſity runs, from which ſome Part f the deltoid Muſcle takes its Riſe: And oppoſite to this, on the convex Edge, a ſcabrous idge gives Inſertion to a Share of the *cuculla- is* Muſcle. The ſuperior Surface of the lavicle here is flat; but the inferior is hol- ow, for lodging the Beginning of the *Muſcu- us ſubclavius.*

External Extremity.

The external Extremity * of this one is horizontally oblong, mooth, ſloping at the poſterior Side, and tipped in a recent Subject with a artilage for its Articulation with the *Acromion ſcapulæ.* Round this the Bone is ſpungy or the firmer Connexion of the Ligaments; and near the Fore-part of this Extremity a little ough Tubercle appears, from which a ſtrong Ligament goes to the coracoid Proceſs of the *Scapula.*

Medullary Veſſels.

The medullary Arteries enter the Clavicles by one or more ſmall Paſ- ages in the poſterior middle Surface, and are all ſlanting outwards.

The

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* Ἐπωμὶς.

Subſtance. The Subſtance of this Bone is th ſame as of the other round lon Bones.

Articulation. It is joined to the *Sternum* b what I called the ſecond Speci of *Ginglymus*, there being Protuberances and Depreſſions of the two Bone that form this movable Joint. The Ligament which ſurround this Articulation to ſecure i are ſo ſhort and ſtrong, that little Motion can b allowed any one Way; and a ſtrong Ligamen that is ſtretched acroſs the upper *Furcula* of th *Sternum* from the poſterior prominent Ang of one Clavicle to the ſame Place of the othe Clavicle, ſerves to keep each of theſe Bone more firmly in their Place. By the Aſſiſtanc however of the movable intervening Cartilage, the Clavicle can at this Joint be raiſed o depreſſed, and moved backwards and forward as much, as that the exterior Extremity, conſidering its Diſtance from that Axis, ſhall enjoy very conſpicuous Motions. The Articulation of the other Extremity of the Clavic ſhall be conſidered after the Deſcription of th following Bone.

Of Infants. The Clavicles of Infants are no deficient in any of their Parts, no have they any Epiphyſes at the Extremities joined afterwards to their Bodies, as moſt other ſuch long Bones hav by which they are not bended too much, no is there Danger of any unoſſified Parts bein ſeparated by the Force which pulls the Arm forwards.

Uſes. The Uſes of the Clavicles are, to kee the *Scapulæ*, and conſequently all th

ſuperio

perior Extremities, from falling in and for- ard upon the *Thorax*; by which, as in moſt uadrupeds, the Motions of the Arms would e much confined, and the Breaſt made nar- wer. The Clavicles likewiſe afford a fixed rigin to ſeveral Muſcles, and a Defence to me of the largeſt Veſſels of the Body.

Scapula.

SCAPULA, or Shoulder-blade *, the triangular Bone ſituated on the utſide of the Ribs, and extended mmonly from the ſecond to the ſeventh true ib; its ſuperior poſterior Angle, when it is the leaſt ſtraining Poſition, being about three ches from the ſpinal Proceſſes of the *Verte- æ*, while the long Side between that Angle d the inferior one is ſtretched obliquely for- ards as it deſcends, having nothing between and the Ribs, except the thin Extremities of me Muſcles; but as the *Scapula* advances rwards to its Articulation with the Arm- ne, its Diſtance from the Ribs increaſes.

The Sides and Angles of the *Scapula* are unequal; for the poſterior Side or Baſe is e longeſt, the inferior *Coſta* is the ſecond Length, and the ſuperior *Coſta* is about as ich proportionally ſhorter than the inferior, this is than the Baſe. The inferior Angle very acute, the ſuperior is near to a right ngle; and what is called the anterior does t deſerve the Name, for the two Sides do t meet to form an Angle. The Body of s Bone is concave towards the Ribs, and con-

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Ὠμοπλάτος, ἐπινώτιον, Latitudo humeri, ſcoptu- a vel ſcutulum opertum, ſpatula, ala, humerus, cly- s, ſcutum thoracis.

convex behind, where it has the Name of *Da*
ſum *. Three Proceſſes are generally recko
ed to proceed from the *Scapula*. The firſt
the large Spine that riſes from the poſteri
convex Surface, and divides it unequall
The ſecond Proceſs ſtands out from the a
terior Extremity of the ſuperior *Coſta*; a
from its imaginary Reſemblance to a Crow
Beak is named *Coracoides* †. The third Pr
ceſs is the whole anterior thick bulbous P
of the Bone.

After thus naming the ſeveral conſtitue
Parts of the *Scapula*, the particular Deſcripti
will be more eaſily underſtood.

Baſe. The Baſe, which is tipped with C
tilage in a young Subject, is not
ſtraight: For above the Spine, this S
runs obliquely forwards to the ſuperior Ang
in which oblique Space the *Muſculus patien*
is inſerted. At the Root of the Spine, on
Back-part of the Baſe, a triangular plain
ſtinct Surface is formed by the lower Fibres
the *Trapezius*. Below this the poſterior E
of the *Scapula* is ſcabrous and rough for
Inſertion of the *Serratus major anticus*
rhomboid Muſcles. The inferior Angle
made ſmooth on its poſterior Surfa
Inferior Coſta. by the *latiſſimus dorſi* paſſing over
From this forwards the inferior *Co*
by the Action of that ſame Muſ
is for ſome Way brought to a more dir
Courſe; and ſo far the poſterior Surfac
flatned by the Origin of the *Teres major*.

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* Χελύνιον.

† Anchoroides, ſigmoides, digitalis, anciſtroides,

his inferior *Coſta* runs forwards from this, it is of a conſiderable Thickneſs; and on its poſterior Surface is ſlightly hollowed, and made ſmooth by the *Teres minor*; while it has a *Foſſa* formed into it below by the *Teres major*; and between the two a Ridge with a ſmall Depreſſion appears, where the *longus extenſor Cubiti* has its Origin. The ſuperior *Coſta* is very thin, and near its anterior Extremity has a ſemilunar Cavity formed in it; croſs the Extremities of which a ſtrong Ligament is ſtretched, and ſometimes the Bone is continued, to form a Hole for the Paſſage of Blood-Veſſels and Nerves. Immediately behind this Cavity the *Muſculus coraco-hyoideus* has its Riſe; and from it to the Termination of the *Foſſa* for the *Teres minor*, the *Scapula* is narrower than any where elſe and ſupports the third Proceſs. This Part has got the Name of *Cervix*.

Superior Coſta.

Dorſum.

The whole *Dorſum* is always ſaid to be convex; but by reaſon of the raiſed Edges that ſurround it, it is divided into two Cavities by the Spine, which is ſtretched from behind forwards, much nearer to the ſuperior *Coſta* than to the inferior. The *Cavitas ſupraſpinata* is really concave where the Muſcle of the ſame Name is lodged; while the Surface of this Bone below the Spine is convex, except a *Foſſa* that runs at the Side of the inferior *Coſta*; and on this Surface the *Muſculus infraſpinatus* is placed.

Internal Surface.

The internal or anterior Surface of this Bone is hollow, except in the Part above the Spine which is convex. In the Hollow the *ſubſcapularis* Muſcle is contained.

tained. When this Muſcle is removed, ſ veral Ridges and intermediate Depreſſions a pear, that at firſt View would ſeem to be dapted to the Ribs; but the *Scapula* is ſituate too obliquely for allowing the Ribs to mak theſe Impreſſions in ſuch a Direction; an they point out the Interſtices of the Bundles Fibres of which the *ſubſcapularis* Muſcle compoſed, as *Winſlow (a)* juſtly obſerves.

Spine. The Spine * riſes ſmall at the Baſ of the *Scapula*, and becomes higher an broader as it advances forwards. O the Sides it is unequally hollowed and crooked by the Actions of the adjacent Muſcles. It Ridge † is divided into two rough flat Surfaces: Into the ſuperior the *Trapezius* Mu cle is inſerted; and from the inferior, Part the *Deltoid* has its Origin. The Extremity the Spine becomes very broad and flat, an

Acromion. is well known by the Name of th *Acromion* * or Top of the Shoulder This in Children is an *Epiphyſe* and in ſome old Subjects I have ſeen it on joined by a Cartilage to the Spine. The interior Edge of the *Acromion* is flat, ſmoot and covered with a Cartilage, for its Articulation with the external Extremity of the Clavicle; and its inferior Surface is hollowed, t allow a Paſſage for the *infra-* and *ſupra-ſpina* Mu

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(*a*) Memoires de l'Acad. des Sciences 1722.

* Ῥάχις, ὑπεροχὴ ὠμοπλατῶν, Eminentia ſcapul rum.

† Pterygium, criſta.

* Ἐπωμὶς, ἀγκυροειδὴς, κορακοειδὴς, κατακλεῖς, A romii os, ſummus armus, roſtrum porcinum, proc digitalis.

Muſcles, and free Motion to the *Os humeri.*

Coracoid Proceſs.

The coracoid † Proceſs is not ſtraight, but a little crooked, with ts Point inclining forwards; ſo that a Hollow is left at its inferior Root, for the Paſſage of the *infra-ſcapularis* Muſcle. The Extremity of this Proceſs is marked with three plain Surfaces: Into the internal, the *Serratus minor anticus* is inſerted: From the external, one Head of the *Biceps flexor cubiti* riſes; and from the inferior, the *Coraco-brachialis* has its Origin. At the ſuperior Root of this Proceſs, immediately before the *Cavitas ſemilunaris*, a plain or rather ſomewhat hollowed Surface is made by the Origin of the other Head of the *Biceps flexor cubiti*; and from a rough ſcabrous Surface on the upper Part of the coracoid *Apophyſe*, ſtrong Ligaments go out, to connect it to the Clavicle and *Acromion.*

Third Proceſs.

From the *Cervix ſcapulæ* the third Proceſs is produced. This is ſuperficially hollowed on the anterior Part by a glenoid Cavity *, which is ſomewhat elliptical; but has an obtuſe Extremity below, and an acute one above; therefore reſembles much the Shape of the longitudinal Section of an Egg. Between the poſterior Brims of this *Glene* and the anterior Root of the Spine a large Sinuoſity is left, for the Tranſmiſſion of the *ſupra-* and *infra-ſpinati* Muſcles. The Root of the *Supercilia* is ſurrounded by a rough Circle, for the firmer

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† Ἀγκυροειδὴς, σιγμοειδὴς, Roſtriformis.

* Ὠμοκότυλις.

Adheſion of the circular Ligament of the Articulation, and of the Cartilage which is placed on theſe Brims, where it is very thick, bu becomes very thin as it is continued toward the Middle of the Cavity, which lines all over. The medullary Veſſels enter the *Scapula* near the Baſ of the Spine.

Medullary Veſſels.

The Subſtance of the *Scapula* is as in all other broad flat Bones, cellular, but of a very unequal Thickneſs; for the Neck and third Proceſs are ver big and ſtrong; the inferior *Coſta*, Spine an coracoid Proceſs, are of a middle Thickneſs and the Body is ſo preſſed by the Muſcles, a to become diaphanous.

Subſtance.

The *Scapula* and Clavicle are joined by plain Surfaces, tipped wit Cartilage *, to which Sort of Articulation I applied the technical Name *Arthrodia*, by which neither Bone is allowe any conſiderable Motion, being tightly tie down by the common circular Ligamen and the proper one that proceeds from th coracoid Proceſs; otherwiſe their Surface c Contact is ſo narrow, that they would be frequently diſlocated: A ſmall Flexion howeve is neceſſary, and therefore they are not unite into one Bone. Sometimes a movable ligamentous Cartilage is found in this Joint, otherwhiles ſuch a Cartilage is only interpoſe at the anterior Half of it, and in ſome old Subjects I have found a ſeſamoid Bone here. Th *Scapula* is connected by *Syſarcoſis* to the Hea

Connexion.

O

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* Acromion, καταλεῖς, clauſuræ,

Os hyoides, *Vertebræ*, Ribs and Arm-bone; and by Means of the Muſcles, that have one Extremity faſtned to theſe Bones, and the other to the *Scapula*, it is moved upwards, downwards, backwards or forwards, and can turn in its own Plain, carrying always the exterior Extremity of the Clavicle and the Arm along with it, which Motions are at great Length explained by *Winſlow (a).* The glenoid Cavity of this Bone receives the *Os humeri* by *Enarthroſis*; of which more hereafter.

Uſes.

The Uſe of the *Scapula* is to ſerve as a *Fulcrum* to the Arm; and, by altering its Poſition on different Occaſions, to allow always the Head of the *Os humeri* a right ſituated Socket to move in, and thereby to aſſiſt and enlarge the Motions of the ſuperior Exrremity, and to afford the Muſcles which riſe from it more advantageous Actions, by altering their Directions to the Bone they are to move. This Bone alſo ſerves to defend the Back-part of the *Thorax*, and is often employed to ſuſtain Weights or reſiſt Forces too great for the Arm to bear.

Of ripe Children.

The Baſe, *Acromion*, coracoid Proceſs and Head of the *Scapula*, are all in a cartilaginous State at the Birth; and the three firſt are joined as *Epiphyſes*; while the Head, with the glenoid Cavity, is not formed into a diſtinct ſeparate Bone, but is gradually produced by the Oſſification of the Body of this Bone being continued forwards.

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(a) Memoires de l'Acad, des Sciences 1726.

Os Humeri.

The *ARM* has only on Bone, beſt known by th *Latin* Name of *OS HUMERI**; which is long, round, and prett ſtraight, only a little convex on the Middl of the Fore-part; and depends from the *Scapula.*

Superior Extremity.

The ſuperior Extremity of thi Bone * is formed into a larg round ſmooth Head, whoſe middle Point is not in a ſtraight Lin with the Axis of the Bone, but ſtands obliquely backwards from it. The Extent of th Head is diſtinguiſhed by a circular *Foſſa* ſurrounding its Baſe, where this Head is unite to the Bone, and from which the circular Ligament of the Joint riſes. Below the anterio Baſe two Turbercles ſtand out: The ſmalle which is the interior, has the Tendon of th *ſubſcapularis* Muſcle inſerted into it. Th larger exterior Protuberance is, at its ſuperio Part, divided into three ſmooth plain Surfaces: Into the anterior of which, the *Muſculus ſupra-ſpinatus*; into the middle or largeſt the *infra-ſpinatus*; into the poſterior, the *Tere minor* is inſerted. Between theſe two Tubercles, exactly in the anterior Part of th Bone, a deep long *Foſſa* is formed for lodgin the tendinous Head of the *Biceps flexor cubiti* which, after paſſing, in a Manner peculiar to itſelf, through the Cavity of the Articulation is tied down by a tendinous Sheath running

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* Ἀκροκολία, ὠλένη, Os brachii, armi, adjutorium parvum brachium, canna brachii.

* Acrocolium.

acroſs the *Foſſa*; in which, and in the neighbouring Tubercles, are ſeveral remarkable Holes, which are penetrated by the tendinous and ligamentous Fibres, and by Veſſels.

On each Side of this *Foſſa*, as it deſcends in the *Os humeri*, a rough Ridge, gently flatned in the Middle, runs from the Roots of the Tubercles: Into the interior the *latiſſimus Dorſi*, *teres major* and *Coraco-brachialis* are inſerted; and into the anterior, the *Pectoralis* terminates. From the poſterior Root of the largeſt Tubercle, ſuch a Ridge alſo is continued, from which the *Brevis extenſor cubiti* riſes. The middle interior Surface of this Bone is flatned by the Belly of the *Biceps flexor cubiti*. In the Middle of this plain Surface the Entry of the medullary Artery is ſeen ſlanting obliquely downwards; and at the Fore-ſide of this Plain the Bone riſes in a Sort of Ridge, which is rough, and often has a great many ſmall Holes in it. At this Place the Tendon of the ſtrong *Deltoid* Muſcle is inſerted, on each Side of which the Bone is ſmooth and flat, where the *Brachiæus internus* riſes. This particularly is largeſt on the Outſide, behind which a ſuperficial ſpiral Channel formed by the *Muſcular* Nerve, runs from behind forwards and downwards. The poſterior Surface of the Body of the *Os humeri* is flatned by the Extenſors of the Fore-arm. Near the under Extremity of this Bone, a large ſharp Ridge is extended on the external Side between the anterior and poſterior Surfaces: From it the *Muſculus ſupinator radii longus*, and the longeſt Head of the *Extenſor carpi radialis* riſe. Oppoſite to this, another

Body.

ſmall Ridge is found, from a ſmall Depre ſion on the anterior Side of which the *Pronator radii teres* riſes.

Inferior Extremity

The Body of this Bone become gradually broader towards the inferior Extremity, where it has ſeveral Proceſſes; at the anterior an poſterior Root of which are two Cavities * The anterior is divided by a Ridge into two the External, which is the leaſt, receives th Extremity of the *Radius*; and the Internal receives the *Coronoid* Proceſs of the *Ulna* in th Flexions of the Fore-arm, while the poſterio deep triangular Cavity lodges the *Olecranon* i the Extenſions of that Member. The Bon betwixt theſe two Cavities is preſſed ſo thin by the Proceſſes of the *Ulna*, as to appear diaphanous. The Sides of the poſterior Cavit are ſtretched out into two Proceſſes, one o each Side of the broad Extremity, theſe ar called *Condyles*, from each of which a ſtron Ligament goes out to the Bones of the *Fore-arm*. The external *Condyle*, which, as *Winſlow (a)* obſerves, has an oblique Directio alſo forwards in reſpect of the internal, whe the Arm is in the moſt natural Poſture, is equally broad, and has an obtuſe ſmooth Hea riſing from it forwards. From the rough Pa of the *Condyle* the inferior Head of the *Bicornis*, the *Extenſor digitorum communis*, *Extenſor carpi ulnaris*, and ſome Part of the *Supinator Radii brevis* take their Riſe; and on th ſmooth Head the ſuperior Extremity of th

Radii

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* Βαθμίδεις.

(a) Memoires de l'Acad. des Sciences 1722.

Radius plays: Immediately on the Outſide of which is a Sinuoſity for the Paſſage of the Muſcular Nerve. The internal *Condyle* is more pointed and protuberant than the external, to give Origin to the *Flexor carpi radialis*, *Pronator radii teres*, *Palmaris longus*, *Flexor digitorum ſublimis*, and *Flexor carpi ulnaris*. Between the two *Condyles*, is the *Trochlea* or Pulley, which conſiſts of two lateral Protuberances and a middle Cavity that are ſmooth and covered with Cartilage; when the Fore-arm is extended, the Tendon of the internal *Brachiæus* Muſcle is lodged in the Fore-part of the Cavity of this Pulley. The external Protuberance, which is much the leaſt, has a ſharp Edge behind; but forwards, this Ridge is obtuſe, and only ſeparated from the little Head already deſcribed, by a ſmall *Foſſa*, in which the conjoined Edges of the *Ulna* and *Radius* move. The internal Protuberance of the Pulley is the largeſt and higheſt, and therefore in the Motions of the *Ulna* upon it, that Bone would be inclined outwards, was it not ſupported by the *Radius* on that Side. Between this internal Protuberance and *Condyle*, a Sinuoſity may be remarked, where the *ulnar* Nerve paſſes. —

Subſtance.

The Subſtance, and the internal Structure of the *Os humeri* is the ſame, and the ſame Way diſpoſed as in other long Bones.

Articulation.

The ſuperior round Head of this Bone of the Arm is articulated by *Enarthroſis*, with the *Glenoid* Cavity of the *Scapula*, which being ſuperficial, and having long Ligaments, allows a free large Motion of this Bone. Theſe Ligamen are however conſiderably ſtrong: For, be ſides the common circular one, the Tendon of the Muſcles perform the ſame Office; an thence have by ſeveral Authors been deſcrib ed as ſo many diſtinct Ligaments. Then th *Acromion* and *Coracoid* Proceſs, with the ſtron Ligaments ſtretched betwixt them, ſecure th Articulation above, where the greateſt an moſt frequent Force is applied, to thruſt th Head of the Bone out of its Place. True is, that below there is not near ſo ſtrong a De fence to the Articulation; but in the ordinar Poſitions of the Arm, that is, ſo long as th Extremity is at an acute Angle with the Trun of the Body, there cannot be any Force ap plied at this Place to occaſion a Luxation ſince the Joint is protected ſo well above.

Motion. The Motions which the Arm en joys by this Articulation are to ever Side, and by the Succeſſion of the different Motions, a Circle may be deſcribed Beſides which, the Bone performs a ſmall Ro tation round its own *Axis*. But tho' this ca be performed by the round Head in all Poſ tions, yet as theſe vary, the Effects upon th Body of the Bone will be very different: Fo if the Middle of the Head is the Centre of Ro tation, as it is when the Arm hangs down b the Side, the Body of the Bone will only b moved forwards and backwards, becauſe, a *Hippocrates* (a) has remarked, the *Axis* of M tion of the Head is near at right Angles wi the Length of the Bone; whereas when th

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(a) De Articulo.

Arm is raiſed to right Angles with the Trunk of the Body, the Centre of Motion and the Axis of the Bone come to be in the ſame traight Line, and therefore the Body of the)s *humeri* will perform the ſame Motion with ts Head. The inferior Extremity of the *Os umeri* is articulated with the Bones of the Fore-arm, ſo as they ſhall follow all its Moions, while on it they perform their own paricular Motions, as ſhall be afterwards deſcribed.

In Infants.

Both Extremities of this Bone are :artilaginous in a new born Infant, .nd the large Head with the two Tubercles, and the *Trochlea* with the two *Condyles*, become *Epiphyſes* before they are united o the Body of the Bone.

FORE-ARM.

The *FORE-ARM* * conſiſts f two long Bones, the *Ulna* nd *Radius*; whoſe Situation, n reſpect of each other, is in the leaſt ſtrainng, or moſt natural Poſition oblique; that is, or Example, the *Ulna* is not directly behind, or on the Outſide of the *Radius*, but in a Middle Situation between theſe two, and the *Radius* croſſes it. But the Situation of theſe wo Bones, and of all the other Bones of the uperior Extremity that are not yet deſcribed, s frequently altered; and therefore, to ſhun xplanatory Repetitions, I deſire it may be now emarked, that in the remaining Account of ne ſuperior Extremity, I underſtand by the erm of Poſterior that Part which is in the ame Direction with the Back of the Hand;

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* Cubitus, πῆχυς, ὠλένη, πυγὼν, Ulna, lacertus.

by anterior, that anſwering to the Palm; by i ternal, that on the ſame Side with the Thum by External, the Side neareſt the little Finge ſuppoſing the Hand always to be in a midd Poſition between *Pronation* and *Supination*.

ULNA *, ſo named from its bei
Ulna. uſed as a Meaſure, is the longeſt of t two Bones of the Fore-arm, and ſit ated on the Out-ſide of the *Radi*
Superior Extremity. At the ſuperior Extremity of t *Ulna* are two Proceſſes: The p ſterior is the largeſt, and form like a Hook, whoſe Concave Surface mov upon the Pulley of the *Os humeri*, and is call *Olecranon* †, or Top of the Cubit: The poſ rior convex Part of it is rough and ſcabro where the *Longus*, *Brevis* and *Brachiæus* e *ternus* are inſerted. The *Olecranon* makes t Paſſage of the Tendons of the Muſcles ov the Extremity of the *Os humeri* unneceſſa which would have been of ill Conſequence the great Flexions of this Joint, or when a conſiderable external Force is applied to t Part, according to the juſt Remark of *W ſlow* (a). The anterior Proceſs is not ſo lar nor reaches ſo high, but is ſharper at its E tremity, therefore named *Coronoid*. Betwe theſe two Proceſſes, a large ſemicircular *ſigmoid* Concavity is left; the Surface which on each Side of a middle Riſing, ſlanting, and exactly adapted to the Pulley

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[*] Cubitus, πῆχυς, προπήχιον, Focile majus. C na vel arundo major & inferior Brachii.

[†] Αγκῶν, Gibber, Cubitus, Additamentum necatum

(a) Expoſition Anatomique du Corps humain, T des Os ſecs § 979.

the Bone of the Arm. Acroſs the Middle of it a ſmall Sinuoſity is ſtretched for lodging mucilaginous Glands; where, as well as in a ſmall Hollow on the internal Side of it, the Cartilage that lines the reſt of its Surface is wanting. Round the Brims of this Concavity the Bone is rough, where the circular Ligament of the Joint is implanted. Immediately below the *Olecranon* a flat triangular ſpungy Surface appears, on which we commonly lean. At the internal Side of this a larger hollow Surface is found, where the *Muſculus Anconæus* is lodged, and the Ridge at the Inſide of this gives Riſe to the *Muſculus ſupinator radii brevis*. Between the Top of this Ridge and the *coronoid* Proceſs a ſemilunated ſmooth Cavity lined with a Cartilage is remarkable, in which the round Head of the *Radius* plays; and immediately below it a rough Hollow gives Lodging to mucaginous Glands. The anterior Root of the *coronoid* Proceſs is ſcabrous and unequal where the *Brachiæus internus* is inſerted; and on the Outſide of that we obſerve a ſmooth Concavity, where the Beginning of the *Flexor digitorum profundus* ſprouts out.

Body.

The Body of the *Ulna* is triangular, the internal Angle of which is very ſharp, where the Ligament that connects the two Bones is fixed; and the Sides, which make this Angle are flat and rough, by the Action and Adheſion of ſo many Muſcles as are ſituate here. A little above the Middle of the anterior Surface the Paſſage of the medullary Veſſels is to be remarked ſlanting upwards. The external Side of this

Bone is ſmooth, ſomewhat convex, and t
Angles at each Edge of it are blunted, by t
Preſſure of the Muſcles equally diſpoſed abo
them.

Inferior Extremity. As this Bone deſcends it b
comes gradually ſmaller, ſo th
its inferior Extremity terminat
in a very little Head, ſtanding c
a ſmall Neck. Towards the anterior but e
ternal Part of which laſt, an oblique Rid
runs, that gives Riſe to the *Pronator radii qu*
dratus. The Head is 'round, ſmooth and c
vered with a Cartilage on its internal Side, t
be received into the ſemilunar Cavity of th
Radius; while from its external Side a *Stylo*
Proceſs * ſtands out, from which a ſtrong L
gament is extended to the *Os piſiforme* and *un*
ciforme of the Wriſt. Between the poſterio
Extremity of that internal ſmooth Side an
this Proceſs, a Sinuoſity is left for the Tendo
of the Extenſor *carpi ulnaris*; and on the Ou
ſide of the Root of the Proceſs, ſuch anoth
Depreſſion may be remarked for the Paſſag
of the *Flexor carpi ulnaris*. The Extremit
of the Bone is ſmooth and covered with
Cartilage, between which and the Bones c
the Wriſt, a doubly-concave movable Cart
lage is interpoſed, that ſeems to be the Carti
lage which covers the inferior Extremity of th
Radius continued. At the internal Root o
the *Styloid* Proceſs, a ſmall rough Cavity i
formed for lodging mucilaginous Glands.

Articulation. The *Ulna* is articulated abov
with the inferior Extremity of th

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* Γραφοειδῆ, Malleolus externus.

Os humeri by *Ginglymus*, which allows an eaſy nd ſecure Extenſion to near a ſtraight Line with the Arm, and Flexion to a very acute Angle; but by the ſlanting Poſition of the Pulley, the inferior Part of the Fore-arm is turned outwards in the Extenſion and inwards in the Flexion, as *Winſlow (a)* has remarked; and alſo a very ſmall Kind of Rotation is allowed in all Poſitions, eſpecially when the Ligaments are moſt relaxed by the Fore-arm being n a middle Degree of Flexion. The *Ulna* is alſo articulated with the *Radius* and *Carpus*, n a Manner afterwards to be related.

At the Birth.

In a Child the *Olecranon* and inferior Head of the *Ulna* are Cartilages, but afterwards become *Epiphyſes*; and the *ſigmoid* Cavity is not entirely bony at the Birth.

Radius.

RADIUS *, ſo called from its imagined Reſemblance to a Spoke of a Wheel, or to a Weaver's Beam, is the interior Bone of the Fore-arm. Its ſuperior Extremity is formed into a circular little Head, which is hollowed for an Articulation by *Arthrodia* with the Tubercle at the Side of the Pulley of the *Os humeri*, and the Half of the round Circumference of the Head next to the *Ulna* is ſmooth, and covered with a Cartilage, to be received into the ſemilunated Cavity of that Bone. Below the Head, the *Radius* is much ſmaller; therefore this Part is named its *Cervix*, which is made round by the Action of the *Supinator Radii brevis*: At the

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(a) Memoires de l'Acad. des Sciences 1722.

* Κερκὶς, παραπήχιον, Focile minus, Canna minor, Arundo minor.

the external Root of this Neck, a tuberou Proceſs riſes, into the poſterior Part of which the *Biceps flexor cubiti* is inſerted. From this a Ridge runs downwards and inwards, wher the *Supinator radii brevis* and *Pronator radi teres* are inſerted.

Body. The Body of the *Radius* is not ſtraight but convex on its internal and poſterio Surfaces, where it is alſo round by the equal Preſſure of the circumambient Muſcles particularly, of the *Extenſors* of the Thumb but the Surfaces next to the *Ulna* are flatne and rough for the Origin of the Muſcles of the Hand, and both terminate in a commo ſharp Spine, to which the ſtrong Ligament betwixt the two Bones of the Fore-arm is fixed A little below the Beginning of the anterio plain Surface, where the Flexor Muſcle o the laſt Joint of the Thumb takes its Origi the Paſſage of the medullary Veſſels is ſeen ſlanting upwards. Towards the inferior Extremity, the *Radius* becomes broader and flatter, eſpecially on its anterior Surface, where its *Pronator quadratus* Muſcle is ſituated.

Inferior Extremity. The inferior Extremity is larger than the ſuperior, tho' not in ſuch a Diſproportion as the ſuperior Extremity of the *Ulna* is large than the inferior. The poſterior Surface o that tuberous Extremity has a flat ſtrong Ridge in the Middle, and *Foſſæ* on each Side: In a ſmall Groove immediately on the Outſide o the Ridge, the Tendon of the *Extenſor terti internodii pollicis* plays. In a large one beyond this, the Tendons of the *Indicator* and common *Extenſor* Muſcles of the Fingers paſs, and then contiguous to the *Ulna* is a ſmall Depreſſion made by the *Extenſor minimi digiti*. On the internal Side of the Ridge, there is a broad Depreſſion, which ſeems again ſubdivided, where the two Tendons of the *Bicornis* or *Extenſor carpi radialis* are lodged. The internal Side of this Extremity of the *Radius*, is alſo hollowed by the Extenſors of the firſt and ſecond Joint of the Thumb; immediately above which, a little rough Surface ſhows where the *Supinator radii longus* is inſerted. The anterior Surface of this Extremity is alſo depreſſed, where the Flexors of the Fingers and *Flexor carpi radialis* paſs. The external Side is formed into a lunated ſmooth Cavity, lined with a Cartilage, for receiving the inferior Extremity of the *Ulna*. The Extremity of this Tuberoſity is formed into an oblong Cavity, in the Middle of which is a ſmall tranſverſe Riſing, gently hollowed, for lodging mucilaginous Glands; while the Riſing itſelf is inſinuated into the Conjunction of the two Bones of the Wriſt that are here received. The internal Side of this Articulation is fenced by a remarkable Proceſs * of the *Radius*, from which a Ligament goes out to the Wriſt, and the *ſtyloid* Proceſs of the *Ulna* guards it on the Outſide.

Of Children.

Both Extremities of the Bones of the Fore-arm, are in Children firſt Cartilages and then *Epiphyſes*, which being larger than the Bodies of theſe Bones, afford a larger Surface for their Articulations, while a conſiderable Space muſt be left

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* Malleolus internus.

left in the Middle between them, which ſupplied by a ſtrong tendinous Membrane, tha allows a ſufficient Origin to the numerou Muſcles, and affords them a Plain to act on and a Defence from Injuries.

Articulation. The *Radius* is articulated wit the Tubercle of the *Os humeri* b *Enarthroſis*, and therefore is bended and extended along with the *Ulna*, whil it may at this Part move round its *Axis* in an Poſition; and that this laſt Motion may be ſufficiently large, the Ligament is extended farther down than ordinary on the Neck of thi Bone, before it is connected to the Bone. Thi Bone is alſo joined to the *Ulna* by a doubl *Enarthroſis*, the *Radius* being received above and the *Ulna* below; which conjunctly conſidered form the third Species of *Ginglymus* But then the Motion performed in theſe two i very different; for at the ſuperior Extremity the *Radius* does no more than turn round it Axis, while at the inferior, it moves in a certain Sort of *Cycloid*, upon the round Extremit of the *Ulna*; and as the Hand is articulate here with the *Radius* it muſt move along wit it. When the Palm is turned uppermoſt, th *Radius* is ſaid to perform the *Supination*; whe the Back of the Hand is above, it is ſaid to b *Prone*. But then the Quickneſs and large Extent of theſe two Motions are aſſiſted by th *Ulna*, which, as was before obſerved, ca move with a kind of ſmall Rotation on th ſloping Sides of the Pulley. This lateral Motion, tho' very inconſiderable in the Joint itſelf, comes to be conſpicuous at the inferio Extremity, which, by the ſtrong Liga connecting it to the *Carpus*, will alſo make he Hand more readily obey theſe Motions. And *laſtly*, when we deſign a large circular Turn of our Hand, we increaſe it by the Roation of the *Os humeri*, and ſometimes employ the Spine and inferior Extremities, to make theſe Motions of Pronation and Supination of the Hand large enough.

Hand. The *HAND* * comprehends all from the Joint of the Wriſt to the Finger Points, of which it may in general be remarked, that all the poſterior Part is convex, for greater Firmneſs and Strength; and before, it is on the contrary concave, for containing more ſurely and conveniently ſuch Bodies as we would hold: As alſo, that one Half has but an obſcure Motion, and ſerves as a Baſe to the other Half, which is endued with large Motion forwards, but can be extended back very little further than a ſtraight Line.

Divided. As the Bones that compoſe it are of different Shapes and Uſes, while ſeveral of them that are adjoining, agree in ſome general Characteriſticks; the Hand is therefore commonly divided into the *Carpus*, *Metacarpus* and *Fingers*, among which the Thumb is reckoned.

Carpus. *CARPUS* † is compoſed of eight ſmall ſpongy Bones ſituated at the upper Part of the Hand. Each of theſe Bones I ſhall deſcribe with *Lyſerus* (*a*), under a proper Name taken from their Figure, becauſe the Method of ranging them by Numbers leaves Anatomiſts too much at Liber to debate very idly, which ought to be prefe red to the firſt Number: Or, which is worſ ſeveral, without explaining the Order they obſerve, differently apply the ſame Number and ſo confound their Readers Ideas. Bu that the Deſcription of theſe Bones may be i the ſame Order with the Generality of Anatomical Books, I ſhall begin with that Range o Bones, that are concerned in the movab Joint of the Wriſt, or are connected to th Fore-arm, and ſhall afterwards conſider th four that ſupport the Thumb and *Oſſa metacarpi* of the Fingers.

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* 'Ακρόχειρ, ſumma Manus.

† Κτείς, Brachiale, prima palmæ pars, raſetta.

(*a*) Cult. Anat. lib. 5. cap. 2.

The eight Bones then of the *Carpus* are, O *ſcaphoides*, *lunare*, *cuneiforme*, *piſiforme*, *trapezium*, *trapezoides*, *magnum*, and *unciform*

The *Scaphoides* is ſituated moſt internally o thoſe that are articulated with the Fore-arm The *Lunare* is immediately on the Outſide o the former. The *Cuneiforme* is placed ſti more externally, but does not reach ſo hig up as the other two. The *Piſiforme* ſtan forwards into the Palm from the laſt. Th *Trapezium* is the firſt of the ſecond Row, ar is ſituated betwixt the *Scaphoides* and firſt Joi of the Thumb. The *Trapezoides* is immediately on the Outſide of the former. The O *magnum* is ſtill more external, and the *Unciforme* is fartheſt to the Side of the little Finge

Scaphoides. *Scaphoides* * is the biggeſt of t eight except one, ſituated on the internal Side of the Joint, convex

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* Κοτυλοειδὲς, Naviculare.

ove, concave below, and oblong: From vhich ſmall Reſemblance of a Boat it has ot its Name. Its ſmooth convex Surface is ivided by a rough Middle *Foſſa*, which runs bliquely croſs it. The ſuperior largeſt Divi-on is articulated with the *Radius*. Into the *'oſſa* the common Ligament of that Joint is xed; and the inferior Diviſion is conjoined o the *Trapezium* and *Trapezoides*. The Con-avity receives more than a Half of the round lead of the *Os magnum*. The external Side f this Hollow is formed into a lunar Plain, to e articulated with the following Bone; and ne internal, poſterior and anterior Edges are ough, for fixing the Ligaments that connect it o the ſurrounding Bones.

Os lunare.

Os lunare * is ſituated immediately n the Outſide of the former, has a mooth convex ſuperior Surface, by vhich it is articulated with the *Radius*. The nternal Side is in Form of a Creſcent, by vhich it is joined with the former Bone; and rom this the Name of this Bone is taken. The nferior Surface is hollow, for receiving Part f the Head of the *Os magnum*. On the Out-de of this Cavity is another ſmooth, but nar-ow oblong Sinuoſity, for receiving the ſupe-ior Extremity of the *Os unciforme*; without vhich a ſmall round Convexity is found for s Connexion with the *Os cuneiforme*. Be-veen the great ſuperior Convexity, and the rſt deep inferior Cavity, is a rough *Foſſa*, in vhich the circular Ligament of the Joint of ne Wriſt is fixed.

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* Lunatum.

Os cuneiforme.

Os cuneiforme † is ſituated o
the external and inferior Side o
the *Os lunare*. It is broad abov
and gradually turns ſmaller below; whic
gives it the Reſemblance of a Wedge. Th
ſuperior Surface is almoſt plain, and include
in the Joint of the Wriſt, being oppoſed to th
Extremity of the *Ulna*. Below this the cune
form Bone has a rough *Foſſa*, wherein the L
gament of the Articulation of the Wriſt
fixed. On the internal Side of this Bon
where it is contiguous to the *lunare*, a ſmoot
ſlightly concave Surface is formed. Its inf
rior Surface is oblong, ſomewhat ſpiral an
concave, for its Connexion with the *Os unc
forme*. Near the Middle of its anterior Su
face a circular Plain appears, where the *Os p
ſiforme* is ſuſtained.

Os piſiforme.

Os piſiforme * is almoſt ſpherica
except one circular plain or ho
low Surface, that ſtands on the la
Bone, from which its whole Body is prom
nent forwards into the Palm; and ſerves fo
fixing the croſs Ligament that defends the Te
dons of the Flexors of the Fingers, and the o
which proceeds from the Extremity of the *U
na*. Into this eighth Bone of the Wriſt, as
is called by *Galen (a)* and moſt of our *Br
tiſh* Writers, the *Flexor carpi ulnaris* is inſe
ted; and from it the *Abductor*, and Part of th
Flexor primi internodii minimi digiti, or rath
Flexor of the fourth metacarpal Bone, hav
the

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† Triquetrum.

* Cartilaginoſum, ſubrotundum, rectum.

(*a*) De uſu Part. Lib. 2. Cap. 12.

heir Origin; and at the internal Side of it a mall Depreſſion is formed, for the Paſſage of he ulnar Nerve.

Trapezium.

Trapezium * is placed above the rſt Bone of the Thumb, and is road and flat at both anterior and oſterior Surfaces; whence it is imagined to eſemble a Table. Its ſuperior ſmooth Surce is ſlightly hollowed and ſemicircular, for s Conjunction with the *Os ſcaphoides*. Its xternal Side is an oblong concave Square, for eceiving the following Bone. The inferior urface is formed into a Pulley, the two proberant Sides of which are external and internal. On this Pulley the firſt Bone of the humb is moved. At the external Side of e external Protuberance, a ſmall oblong nooth Surface is formed by the *Os metacarpi dicis*. The anterior Part of the *Trapezium* prominent in the Palm, and near the exteral Side has a Sinuoſity in it, where the Tenon of the *Flexor carpi radialis* is lodged, on e ligamentous Sheath of which the Tendon the *Flexor tertii internodii pollicis* plays; and ithout that, the Bone is more than ordinary abrous, where the croſs anterior Ligament the Wriſt is connected, and the *Abductor* d *Flexor primi internodii pollicis* have their rigin.

Os trapezoides.

Os trapezoides † is the ſmalleſt one of the Wriſt, except the *piorme*, ſituated on the Outſide of e former. The Figure of it is an irregular

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* Os cubiforme, trapezoides, multangulum majus.

Trapezium, multangulum minus.

Cube. It has a ſmall ſuperior hollow Surfa by which it joins the *ſcaphoides*; a long co vex one internally, where it is contiguous the *Trapezium*; a ſmall external one, for Conjunction with the *Os magnum*; and an ferior convex Surface, the anterior and poſt rior Edges of which are however raiſed, that a ſort of Pulley is formed at this Pla where it ſuſtains the *Os metacarpi indicis*.

Os magnum.

Os magnum †, ſo called beca it is the largeſt Bone of the *Carp* is oblong, almoſt ſquare, wit round ſuperior Extremity, and triangular in rior plain one. The round Head is divided a ſmall Riſing, oppoſite to the Connexion the *Os ſcaphoides* and *lunare*, which toge form the Cavity for receiving it. On the ſide a ſhort plain Surface joins the *Os magn* to the *Trapezoides*. On the Outſide is a l narrow concave Surface, where it is conti ous to the following Bone. The inferior angular Extremity, which ſuſtains the m carpal Bone of the middle Finger, is ſlig hollowed, and farther advanced on the in nal Side than on the external, having a co derable oblong Depreſſion made on that vanced Inſide by the metacarpal Bone of Fore-finger.

Os unciforme.

*Os unciforme** has got its N from a thin broad Proceſs ſtands out from it forwards the Palm, and is hollow on its internal S for affording a Paſſage to the Tendons of Fle

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† Maximum, capitatum.

* Cuneiforme.

Flexors of the Fingers. To this Proceſs alſo he croſs Ligament is fixed, that binds down nd defends theſe Tendons, and the *Flexor* nd *Abductor* Muſcles of the little Finger riſe rom it. The ſuperior plain Surface is ſmall nd convex to be joined with the *Os lunare*: The internal Side is long and ſlightly convex dapted to the adjoining *Os magnum*: The exernal Surface is oblique and irregularly conex to be articulated with the cuneiform Bone: And the inferior Extremity is divided nto two concave Surfaces; the external for he metacarpal Bone of the little Finger, and he internal for that of the Ring-finger.

In the Deſcription of the preceding eight Bones, I have only mentioned thoſe plain Surfaces covered with Cartilage, by which hey are articulated to each other, or to ſome other Bones, except in a few Caſes, where omething extraordinary was to be obſerved; nd have of deſign omitted the other rough Surfaces, leſt by crowding too many Words n the Deſcription of ſuch ſmall Bones, the whole ſhould be unintelligible: While theſe Parts of the Bones, after mentioning their Fiure, may eaſily enough be underſtood, if it s obſerved, that they are generally found nly towards the Back or Palm of the Hand, hat they are all plain, larger behind than efore, and receive the different Ligaments, y which they are either connected to neighouring Bones, or to one another; for theſe Ligaments cover all the Bones, and are ſo acurately applied to them, that, as *Galen* (a) obſerves,

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(a) De uſu Part. Lib. 2. Cap. 8.

obſerves, at firſt View the whole *Carpus* appears one ſmooth Bone.

Figure. As the poſterior Surfaces of the Bones are largeſt, the Figure of th whole conjoined muſt therefore b convex behind, and concave before; whic Concavity is ſtill more increaſed by the *Os piſiforme*, and Proceſs of the *Os unciforme*, ſtanding inwards on one Side, and the *Trapeziu* on the other. The Convexity behind rende the whole Fabrick ſtronger, where it is mo expoſed to Injuries; and the large Hollow neceſſary before, for a ſafe Paſſage to the numerous Tendons of the Fingers. This Figu is likewiſe ſecured by the ſtrong croſs Lig ment ſtretched from the one Side to the othe

Subſtance. The Subſtance of theſe Bones ſpungy and cellular, but pretty ſtron in reſpect of their Bulk.

Articulation. The three firſt make an oblon Head, by which they are artic lated to the inferior Extremity the Bones of the Fore-arm by *Enarthroſis*; an therefore can be moved to all Sides, and by quick Succeſſion of theſe Motions, may b moved in a Circle. But then, as the Joint oblong, and therefore the two Dimenſions u equal, no Motion is allowed to the *Carp* round its Axis, except what it has in the Pr nation and Supination along with the *Radiu* The Articulation of the firſt three Bones of th ſuperior Row, with the Bones of the inferio is ſuch as allows of Motion, eſpecially bac wards and forwards; to the Security and E ſineſs of which, the *Enarthroſis* of the *Os m gnum* with the *ſcaphoides* and *lunare* contr

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butes conſiderably: And the greateſt Number of the Muſcles that ſerve for the Motion of the Wriſt on the *Radius*, being inſerted beyond the Conjunction of the firſt Row of Bones with the ſecond, act equally on this Articulation as they do on the former; but the Joint formed with the *Radius* being the moſt eaſily moved, the firſt Effect of theſe Muſcles will be on it, and the ſecond Row of the *Carpus* is only moved afterwards. By this means a larger Motion is allowed at the Wriſt, than otherwiſe would; or, if as large Motion had been given to one Articulation, the Angle of Flexion would have been very acute, and the Ligaments muſt have been longer than was conſiſtent with the Firmneſs and Security of the Joint. The other Articulations of the Bones here being by nearly plain Surfaces, which I called *Arthrodia*, ſcarce allow any more Motion, becauſe of the ſtrong connecting Ligaments, than, on the Application of any external Power, to yield a little, and ſo elude the Force of it; and, on proper Occaſions, to render the Back of the Wriſt a little more flat, or the Palm more hollow. The Articulations of the Thumb and metacarpal Bones ſhall be ſpoke to hereafter.

The Uſes of the *Carpus* are, to ſerve as a Baſe to the Hand, to protect its Tendons, and to afford it a free large Motion. *Uſes.*

All the Bones of the *Carpus* are in a cartilaginous State at the Time of Birth. *Of Infants.*

Metacarpus. *METACARPUS* * conſiſ of four Bones, which ſuſtain th Fingers. Each Bone is long an round, with the Extremities larger than th Body. The ſuperior Extremity, which ſom call the Baſe, is flat and oblong, without an conſiderable Head or Cavity; but is howeve ſomewhat hollowed, for the Articulation wi the *Carpus:* And on one or both Sides this Ba is flatned and ſmooth, where theſe Bones ar contiguous to each other. Their Bodies ar ſomewhat round, but from their inferior Extremity to near their Middle, are flatned behind by the Tendons of the Extenſors of th Fingers. The anterior Surface of theſe Bodies is a little concave, eſpecially in the Middle; along which a ſharp Ridge ſtands ou which ſeparates the *Muſculi interoſſei*, place on each Side of theſe Bones, which are then made flat and plain by theſe Muſcles.

Their inferior Extremities are raiſed int large oblong ſmooth Heads, whoſe greate Extent is forwards from the Axis of the Bone At the anterior Root of each of theſe Heads, on or two Tubercles ſtand out for ſecuring th Ligaments of the Joint, and for fixing the Ligaments that go from one metacarpal Bone to another, to preſerve them from being drawn aſunder: Round the Heads a rough Ring may be remarked, for the circular Ligament of the Joints to be fixed to; and both Sides o theſe Heads are flat, by preſſing on each other The Length of theſe Bones is generally diminiſhed in proportion to their Diſtance from the Thumb.

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* Κτεὶς, προκάρπιον, στῆθος, ἄνδηρον, κτενίον, Poſtbrachiale, pectus, palma, pecten.

The Subſtance of the metacarpal Bones is common to all the Claſs of long Bones.

At the Birth. At the time of Birth theſe Bones are cartilaginous at both Extremities; which, after being oſſified, are at laſt joined to their Bodies, as all *Appendices* are to their reſpective Bones.

Diſtinguiſhed. Tho' they ſo far agree, yet they may be diſtinguiſhed from each other by the following proper Characters.

Indicis. The *Os metacarpi indicis* is generally the longeſt. Its Baſe, which is articulated with the *Trapezoides*, is hollow in the Middle. The ſmall Ridge on the internal Side of this oblong Cavity is ſmaller than the one oppoſite to it, and is made flat on the Side by the *Trapezium*. The exterior Ridge is alſo ſmooth and flat on its Outſide, for its Conjunction with the *Os magnum*; immediately below which a ſemicircular ſmooth flat Surface ſhews the Articulation of this Bone to the following one. The poſterior Part of this Baſe is flatned where the long Head of the *Extenſor carpi radialis* is inſerted, and the Fore-part of the ſame Baſe is prominent where the Tendon of the *Flexor carpi radialis* is fixed. The external Side of the Body of this Bone is more hollowed by the Action of Muſcles than the internal. The Tubercle at the internal Root of its Head is larger than the external.

Medii digiti. *Os metacarpi medii digiti* is generally the ſecond in Length, but often it is as long as the former, ſometimes longer; and frequently it only appears to equal the firſt, by its ſupporting Ba being the fartheſt advanced. Its Baſe is broad ſuperficial Cavity, ſlanting outwards the internal poſterior Angle of which is ſo prominent as to have the Appearance of a Proceſ The internal Side of this Baſe is made plain i the ſame Way as the external Side of the former Bone, while its external Side has tw hollow circular Surfaces, for joining the fo lowing; and between theſe Surfaces a roug *Foſſa* is found, for the Adheſion of a Ligamen and lodging mucilaginous Glands. The ſhorter Head of the *Bicornis* is inſerted into th Back-part of this Baſe. The two Sides o this Bone are near equally flatned, only th Ridge on the anterior Part of the Body is inclined more externally. The Tubercles a the anterior Root of the Head are equal.

Digiti annularis.

Os metacarpi digiti annular is at its Baſe of a ſemicircula Figure, and convex, for it Conjunction with the *Os unciforme*. On it internal Side are two ſmooth Convexities an a middle *Foſſa*, adapted to the former Bone and the external Side has a triangular ſmoot concave Surface, to join it with the following The anterior Ridge of its Body is ſituated mor to the Outſide. The Tubercles near the Hea are equal.

Minimi digiti.

Os metacarpi minimi digiti i the ſmalleſt and ſharpeſt. It Baſe is irregularly convex, an riſes ſlanting outwards. Its internal Side i exactly adapted to the former; but the exter nal has no ſmooth Surface, becauſe it is no contiguous to any other Bone, but it is prominent where the *Extenſor carpi ulnaris* is inſerted. As this *Os metacarpi* is furniſhed with a proper moving Muſcle, has the plaineſt Articulation, is moſt looſely connected and leaſt confined, it enjoys a much larger Motion than any of the reſt; ſo that the Palm of the Hand may be conſiderably hollowed by the Advance of this Bone forwards, and by the Prominence of the Thumb oppoſite to it.

Articulation. The metatarſal Bones are joined above to the *Oſſa carpi* by *Arthrodia*; but ſeveral of them having different Surfaces, by which they are contiguous to each other, their Articulation comes under what I called the third Species of *Ginglymus*. The Motion in any of them is not very conſiderable, but the exterior have more than thoſe that are placed nearer to the Thumb. Their Articulations with the firſt *Phalanx* of the Fingers is by *Enarthroſis*.

Uſes. Theſe four Bones by their Length make the Hand very capacious, their anterior Concavity forming the Hollow of the Palm, which can be increaſed at pleaſure by the Motion of the more external of theſe Bones forwards. The Interſtices between them allow ſome Muſcles and their Tendons to paſs ſecurely, and afford Origin and Lodging to other Muſcles: On their round Heads the Fingers move freely.

Digiti. The *THUMB* and four *FINGERS* are each compoſed of three long Bones, that enjoy a large Motion. The Bones are framed after the ſame Manner in the different Fingers; but the

Thumb differs from them in its Structure, ar therefore ought to be conſidered ſeparately.

Thumb. The *Thumb* * is ſituated obliquel in reſpect of the Fingers, neither opposite directly to them, nor in th ſame Plain with them. All its Bones ar much thicker and ſtronger in Proportion t their Length: Which was extremely neceſſary, ſince the Thumb counteracts all the conjoined Fingers.

1ſt Bone. The firſt Bone of the Thumb has it Baſe adapted to the double Pulley o the *Trapezium*: For in viewing i from one Side to the other, it appears conve in the Middle; but when conſidered from behind forwards it is there concave. The anterior Edge of this Baſe is produced farthe than any other Part; and round the poſterio a rough *Foſſa* may be ſeen, for the Connexio of the Ligaments of this Joint. The Bod and Head of this Bone are of the ſame Shap as the *Oſſa metacarpi*; only that the Body i ſhorter, and the Head flatter, with the Tubercles at its anterior Root larger.

Articulation. The Articulation of this Bon is pretty ſingular. For tho' it is *Ginglymus*, yet, by being forme into a double Pulley, it enjoys the Motion o an *Enarthroſis*; only is ſomewhat more confined and leſs expeditious, but ſtronger an more ſecure, than generally the *Enarthroſis* is.

Of Infants. This Bone of Children is in th ſame State with the metacarpa Bones.

The

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* Ἀντίχειρ, δικόνδυλος, Magnus digitus, promanus.

2d Bone.

The ſecond Bone of the Thumb as a large Baſe formed into an obong Cavity, whoſe greateſt Length s from one Side to the other. Round it ſeveal Tubercles may be remarked, for the Inertion of Ligaments. Its Body is convex, or half-round behind; but flat before, for lodgng the Tendons of the Flexors, which are ied down by ligamentous Sheaths that are fixd on each Side to the Angle at the Edge of nis flat Surface. The under Extremity of his ſecond Bone has two lateral round Prouberances, and a middle Cavity, whoſe greatſt Extent of ſmooth Surface is forwards.

Articulation.

The Articulation and Motion f this ſecond Bone is as ſingular s of the former. For its ſupeior Extremity is articulated by *Enarthroſis*; et becauſe of the Strength of its lateral Ligaments, oblong Figure of the Joint itſelf, and Iobility of the firſt Joint, it only has the two Iotions of a *Ginglymus*, Flexion and Extenon, and theſe are generally much confined.

3d Bone.

The third Bone of the Thumb is ne ſmalleſt, with a large Baſe, whoſe reat Extent is from one Side to the ther. This Baſe is formed into two Cavities nd a middle Protuberance, to be adapted to ne Pulley of the former Bone. Its Body is ounded behind, but flatter than in the former one, for ſuſtaining the Nails; but is flat and ough before, by the Inſertion of the *Flexor ter- i internodii*. This Bone becomes gradually naller, till near the under Extremity, where it a little enlarged, and has an oval ſcabrous dge.

The

Articulation. The Motion of this third Bo is proper to its Articulation *Gi glymus.*

Phalanges digitorum. The orderly Diſpoſition of th Bones of the Fingers into Rows ha made them generally obtain th Name of three *Phalanges* †; all which are ſituated with their half-round Su faces directly backwards, for their great Strength, and the flat concave Part before, fo taking hold more ſurely, and for lodging th Tendons of the Muſcles that move them. Th Ligaments for keeping down the Tendons the Flexor Muſcles are fixed to the Angle th is on each Side between the poſterior Conve ty and this anterior Concavity. Theſe Bon are ſmaller, in proportion to their Length than the Bones of the Thumb, as was alrea remarked.

1. The Bones of the firſt *Phalanx* * of th Fingers anſwer to the Deſcription of th ſecond Bone of the Thumb; only that th Cavity in their Baſe is not ſo oblong, nor their Motion on the metacarpal Bones much confined; for they can be moved l terally or circularly, but have no Rotatio round their Axes.

Of Children. Both the Extremities of this fir *Phalanx* is in a cartilaginous Sta at the Birth, and the ſuperior is a terwards affixed in Form of an *Epiphyſis.*

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† Scytalidæ, internodia, ſcuticula, agmina, acies, co dyli, articuli.

* Περικόνδυλοι.

The ſecond Bone ‡ of the Fingers has
s Baſe formed into two lateral Cavities, 2.
ıd a middle Protuberance; while the in-
rior Extremity has two lateral Protuberances
nd a middle Cavity; therefore, contrary to
ny Bone of the Thumb, is joined at both Ex-
remities by *Ginglymus*.

This Bone is in the ſame Con-
ition with the former in Chil- *Of Infants.*
ren.

The third Bone † differs nothing from
ıe Deſcription of the third Bone of the 3.
humb, excepting in the general di-
inguiſhing Marks; and therefore theſe two
njoy only Flexion and Extenſion.

The ſuperior Extremity of this
ird *Phalanx* is a Cartilage in *At the Birth.*
ripe Child, and is only an
piphyſe after, till the full Growth of the
ody.

All the Difference of the *Pha-*
nges of the ſeveral Fingers con- *Diſtinguiſhed.*
ſts in their Magnitude: The
ones of the *Middle-finger* * being the longeſt
nd largeſt; thoſe of the *Fore-finger* ‡ come
ext to that. The *Ring-finger* † is the third in
igneſs, and the *Little-finger* * is the leaſt.
Vhich Diſpoſition is the beſt Contrivance for
hold-

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‡ Κώνδυλοι.

† Μετακόνδυλοι, ῥιζωνύχια.

* Καταπυγὼν, σφάκελος, Infamis, impudicus, ver-
ıs, famoſus, obſcænus.

‡ Δεικτικὸς, indicator, λιχανὸς, demonſtrativus, ſa-
taris.

† Ἰατρικὸς, παράμεσος, δακτυλιώτης, ἐπιβάτης, An-
ılaris, medicus, cordis digitus.

* Μύωψ, ὠτίτης, Auricularis, minimus.

holding the largeſt Bodies; becauſe the lon eſt Fingers are applied to the middle larg Periphery of ſuch Subſtances as are of a ſph rical Figure, as was remarked of old by *Gal* (a).

The Advantages we acquire by our ſuperi Extremities, and their ſeveral Parts, are ſo vident in all the common Actions of Life, th they muſt readily occur to the meaneſt Cap city; and therefore, without mentioning an of them, I ſhall proceed to the laſt Part of th Skeleton: Only, leſt I ſhould ſeem to hav forgot the ſmall little Bones at the Joints the Hand, I deſire now to refer to the D ſcriptionof them, under the common Title *Seſamoid Bones*, which I have placed after th Bones of the Feet.

Of the inferior Extremities.

INFERIOR EXTREMITIES.

THE *INFERIOR E TREMITIES* compr hend all thoſe Parts dependi from the *Acetabula* of the *O innominata*, and are commonly d vided into three Parts, *viz.* th Thigh, Leg and Foot.

Divided.

THIGH.

The *THIGH* * has only one Bon which is the longeſt of the Body, a the largeſt and ſtrongeſt of any of th cylindrical Bones. The Situation of it is n perpendicular: For the lower End is incline conſiderably inwards; ſo that the two Kne a

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(*a*) De uſu part. lib. 1. cap. 24.

* Μηρὸν, Femen, coxa, agis, anchæ os, crus, femur

re near contiguous, while there is a conſi-
erable Diſtance between the Thigh-bones a-
ove: Which is of good Uſe to us, ſince ſuf-
cient Space is thereby left for the external
Parts of Generation, the two great *Cloacæ* of
Urine and *Fæces*, and for the large thick Muſ-
les that move the Thigh inwards; and at the
ame Time this Poſition renders our Progreſ-
ion quicker, ſurer, ſtraighter, and in leſs
Room. For had the Knees been at a Diſtance
rom each other, we muſt, to have made a
ong Step, have been obliged to deſcribe ſome
Part of a Circle with the Trunk of our Body;
nd, if one Leg was raiſed from the Ground,
our Centre of Gravity would have been too
far from the Baſe of the other, and we ſhould
conſequently have been in Hazard of falling;
ſo that our Steps would neither have been
ſtraight nor firm, nor would it have been poſſible to walk in a narrow Path, had our Thigh-bones been otherwiſe placed. In conſequence
however of the Weight of the Body bearing
ſo obliquely on the Joint of the Knee by this
Situation of the Thigh-bones it is that weak
rickety Children become inkneed.

Superior Extremity.

The Superior Extremity of the Thigh-bone is not continued in a ſtraight Line with the Body of it, but is ſet off obliquely inwards and upwards, whereby the Diſtance between theſe two Bones is conſiderably increaſed above. When this Extremity firſt goes off, it is ſmall, but afterwards is formed into a large round *Head* *, which is the greater Portion of

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* Vertebrum.

a Sphere unequally divided. This Head
ſmooth and covered with a Cartilage to p
in the *Acetabulum Iſchii*. Towards its inf
or internal Part a round rough ſpongy Pit
obſervable, where the ſtrong Ligament, wh
is commonly called the *round* one, but tha
of rather an oval Figure in its tranſverſe Sec
ons, is fixed, to be extended from thence
the inferior internal Part of the receiving Ca
ty, where it is conſiderably broader than in
Progreſs to the Head of the Thigh-bone. T
Cervix of the *Os Femoris* has a great ma
large Holes, into which the Fibres of t
ſtrong Ligament that covers it enter, and a
thereby ſurely united to it; and round t
Root of the Neck where it riſes from t
Bone, a rough Ridge is found, where the c
cular Ligament of the Articulation is connec
ed. Below the back Part of this Root, t
large unequal Protuberance, called the *Tr*
chanter major * is obſervable; at the ſuperi
Root of which, a Cavity is left for the Inſe
tion of the *Muſculus glutæus minimus*; a
immediately without that, is another, whe
the *Pyriformis*, *Marſupialis* and *Gemini* a
inſerted. On the ſuperior Extremity of t
Proceſs is a ſmooth flat Surface, where t
Glutæus medius is attached; and without a
below that, a large ſmooth Surface is to
ſeen for the Inſertion of the *Glutæus max*
mus. From the poſterior Face of the Ro
of this great *Trochanter*, a rough Ridge ru
backwards and downwards, into which t

Qu

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* Γλȣτὸς, Rotator natis, malum granatum teſticul
rum.

uadratus is inſerted. In the Hollow, at the
ternal Side of this Ridge, the *Obturator ex-*
rnus is implanted ; and at its interior Extre-
nity we find a conoid Proceſs called *Troch-*
nter minor *, into which the *Muſculus Pſoas*,
nd *Iliacus internus* are inſerted, and the *Pecti-*
eus is implanted into a rough Hollow below
e internal Root of it. The Muſcles inſert-
d into theſe two Proceſſes being the princi-
al Inſtruments of the rotatory Motion of the
Thigh, have occaſioned the Name of *Troch-*
nters to the Proceſſes.

Body.

The Body of the *Os femoris* is convex
n the anterior Part, and made hollow
ehind by the Action of the Muſcles
hat move upon it, and for the Conveniency
f ſitting, without bearing ſo much on theſe
Muſcles ; and probably the Weight of the
Legs depending from the Thighs in that Po-
ture contributes conſiderably to this Curva-
ure. The anterior Surface is a little flatned
bove by the Beginning of the *Crureus* Muſ-
le, as it is alſo below by the *Rectus* and *Cru-*
eus. The external Surface is likewiſe made
lat below by the *Vaſtus externus*, where it is
ſeparated from the former by an obtuſe Ridge.
The *Vaſtus internus* depreſſes a little the internal inferior Surface. The poſterior concave Surface has a Ridge riſing in its Middle, commonly called *Linea aſpera*, into which the *Triceps* is inſerted. At the ſuperior Part of it the medullary Veſſels enter by a ſmall Hole that runs obliquely upwards, a little above which is a rough *Foſſa* or two, where the

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* Rotator minor.

tendinous Expanſion of the *Glutæus maxim* is fixed. The inferior Extremity of the *Lin* *aſpera* divides into two, ſtretching to each Sid the long Head of the *Triceps* being inſerted i to the internal, and the ſhort Head of the *B* *ceps Flexor Tibiæ* riſing from the externa Between theſe two rough Lines, the Bone made flat by the large Blood-veſſels an Nerves which paſs upon it; and near th Extremity of each of theſe Ridges, a ſma ſmooth Protuberance may often be remarke where the two Heads of the *Muſculi Gaſtr* *cnemii externi* take their Riſe; and the ſ ſamoid Bones deſcribed by *Veſalius* (a) ſom times are found.

Inferior Extremity.

The inferior Extremity of the *O* *femoris* is larger than any oth Part of it, and formed into a gre Protuberance on each Side calle its *Condyles*; between which a conſiderab Cavity is found, eſpecially at the poſteri Part. The internal Condyle is longer tha the external, which muſt happen from the o blique Poſition of this Bone, to give leſs O bliquity to the Leg. Each of theſe Proceſſ ſeems to be divided in its plain ſmooth Surface. The mark of Diviſion on the externa is a Notch, and on the internal a Protuberance. The anterior Part of this Diviſion i formed like a Pulley, the external Side o which is higheſt. On it the *Rotula* plays. Th poſterior Part has two oblong large Heads whoſe greateſt Extent is backwards for th Motion of the *Tibia*; and from the rough Ca vity between them, but near the Baſe of the nternal Condyle, the ſtrong Ligament commonly called the *croſs* one has its Riſe. The Sides of the Condyles are made flat by the Muſcles paſſing along them; and on the back Part of the internal Side a ſlight *Foſſa* ſeems to be made by the Tendons of the *Gracilis* and *Sartorius*; but on the external a conſiderable Depreſſion is formed by the *Biceps flexor cruris*. A little farther forward than where theſe Depreſſions are on each of the Condyles, the lateral Ligaments of the Joint of the Knee riſe out from the *Os femoris*. Round this inferior Extremity of the Thigh-bone, large Holes are found into which the Ligaments for the Security of the Joint are fixed, and Blood-veſſels paſs to the internal Subſtance of the Bone.

(a) Lib. 1. cap. 28. & 30.

In Children.

All the Proceſſes of the *Femur* in new born Children are cartilaginous, and afterwards become ſmall *Apophyſes*, with large *Epiphyſes*.

Articulation.

The Thigh-bone is articulated above with the *Acetabulum* of the *Oſſa innominata* by *Enarthroſis*, and therefore can be moved to every Side, but is reſtrained in its Motion outwards by the high Brims of the Cavity, and by the round Ligament; for otherwiſe the Head of the Bone would be frequently thruſt out at the Breach of the Brims on the Inſide, which allows the Thigh to move conſiderably inwards. The Body of this Bone enjoys little or no rotatory Motion, tho' the Head moſt commonly moves round its own Axis, becauſe the oblique Progreſs of the Neck and Head from the Bone is ſuch, that the rotatory Motion o the Head can only bring the Body forward and backwards; nor is this Head, as in the Arm, ever capable of being brought to a ſtraight Direction with the Body; ſo far however as the Head can move within the Cavit in a Circle backwards and forwards, the reſ of the Bone may have a partial Rotation. Th *Os femoris* is articulated below to the *Tibi* and *Rotula* by *Ginglymus*.

Leg.

The *LEG* * is compoſed, according to the common Account, of tw Bones, *Tibia* and *Fibula*, tho' it ſeem to have a very good Title to a third, the *Rotula*; ſince this, tho' a diſtinct Bone, bears a ſtrong Analogy to the *Olecranon* or ſuperio great Proceſs of the *Ulna*; therefore I ſhall rank the *Rotula* with theſe other two Bones.

Tibia.

TIBIA †, ſo called from its Reſemblance to an old Muſical Pipe o Flute, is the long thick triangula Bone, ſituated at the anterior internal Part o the Leg, and continued in near a ſtraight Line from the Thigh-bone, to ſupport the whole ſuperior Fabrick.

Superior Extremity.

The ſuperior Extremity of the *Tibia* is large, bulbous and ſpongy, and is divided into two Cavities by a rough irregular Protuberance ‡, which again is hollow at its moſt prominent Part, as well as at its poſterior and anterior

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* Κνήμη, Crus, tibia.

† Προκνήμιον, *ἀντικνήμιον*, focile majus, arundo major, canna major, canna domeſtica cruris.

‡ Διάφυσις, ἐξοχὴ νευροχονδρώδης, Tuber, Tuberculum.

Baſe. The anterior of the two Ligaments that compoſe the great *Croſs* one, is inſerted into the Middle Cavity, and the poſterior Depreſſion of this irregular Proceſs receives the poſterior Ligament. The two broad Cavities at the Sides of this Protuberance are not equal; for the internal is oblong and deep to receive the internal *Condyle* of the Thigh-bone, while the external is more ſuperficial and rounder for the external Condyle. In each of theſe two Cavities of a recent Subject a ſemilunar Cartilage is placed, the convex Edge of which is thick, and the Cartilage becomes gradually thinner towards the concave or interior Edge. The Middle of each of theſe Cartilages is broad, and the Extremities turn narrower and thinner as they approach the middle Protuberance of the *Tibia*. The thick convex Edge of each Cartilage is connected to the circular Ligament of the Articulation, but ſo near to its Riſe from the *Tibia* that the Cartilages are not allowed to change Places far; while the narrow Extremities of theſe Cartilages becoming almoſt Ligaments, are fixed at the Inſertion of the ſtrong croſs Ligament into the *Tibia*, and ſeem to have their Subſtance blended with that Ligament; therefore a circular Hole muſt be left between each Cartilage and the Ligament, in which the moſt prominent convex Part of each Condyle of the Thigh-bone moves. In the Circumference of theſe Cavities deſcribed, the ſuperior Extremity of the *Tibia* is rough and unequal for the firm Connexion of the Ligaments of the Joint. Immediately below the poſterior Edge two rough flatned Protuberances ſtand out:

Into the internal the Tendon of the *ſemimembranoſus* Muſcle is inſerted; and ſome Part o the croſs Ligament is fixed to the externa On the Outſide of this laſt Tubercle, a ſmoot ſlightly-hollowed Surface is formed by th Action of the *Poplitæus* Muſcle.

Body. Below the anterior Part of the uppe Extremity of the *Tibia*, a conſiderabl rough Protuberance * riſes, to whic the ſtrong tendinous Ligament of the *Rotula* i fixed. On the internal Side of this, a ſcabrous Cavity is formed, where the *ſemi-nervoſus*, *gracilis* and *ſartorius* Muſcles are inſerted. Whence Surgeons know at what Par the *Tibia* ought to be ſawed through in a Amputation, ſo as not to have too long an troubleſome a Stump, and at the ſame Tim to preſerve the Motions of the Leg, by ſawing the proper moving Muſcles. Below th external Edge of this ſuperior Extremity, circular flat Surface covered in a recent Subject with Cartilage, is found for the Articulation of the *Fibula*. Between which and th anterior Knob is a rough Hollow from whic the *Tibialis anticus* and *Extenſor digitorum longus* take their Origin. From the ſmoot flat Surface, a Ridge runs obliquely downwards and inwards, to give Riſe to the *Tibialis poſticus*. At the Inſide of this Ridge, a oblique plain Surface is left, where the *Muſculus Poplitæus* is inſerted, and Part of th *Solæus* has its Origin. The remaining Bod of the *Tibia* is triangular, the anterior Angl of which is very ſharp, and is commonly cal

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* Ἀντικνήμιον, Anterior Tuber.

led the *Spine* or *Shin* *: This Ridge is not ſtraight, but turns firſt inwards, then out, and laſtly in again. The plain internal Side is ſmooth and equal, being little ſubjected to the Actions of Muſcles; but the external Side is hollowed above by the *Tibialis anticus*, and below by the *Extenſor digitorum longus*, and *Extenſor pollicis longus*. The two Angles behind theſe Sides are rounded by the Action of the Muſcles; and the poſterior Side comprehended between them, is not ſo broad as thoſe already mentioned, but is more oblique and flatned by the Action of the *Tibialis poſticus* and *Flexor digitorum longus*. Some Way above the Middle of the Bone, the internal Angle terminates, and the Bone is made round, but rough, by the Preſſure of the *Muſculus ſoleus*. Near to this, the Paſſage of the medullary Veſſels is ſeen ſlanting obliquely downwards in the poſterior plain Surface.

Inferior Extremity,

The inferior Extremity of the *Tibia* is made hollow, but ſo as a ſmall Protuberance riſes in the Middle. The internal Side of this Cavity, which is ſmooth, and in a recent Subject is covered with a Cartilage, is produced into a conſiderable Proceſs, commonly named *Malleolus internus* *, whoſe Extremity is divided by a Notch, and from it Ligaments are ſent out to the Foot. We ought to ob-

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* Ἄκανθα, Spina, crea, linea prima tibiæ, angulus acutus.

* Σφυρὸν, ϖέσον, Talus, clavicula, cavilla interior, cavilla domeſtica.

obſerve here with *Winſlow (a)*, that this internal *Malleolus* is ſituated more forwards tha the internal Condyle of the ſuperior Extremity of this Bone, which is neceſſary to be remarked in reducing a Fracture of the Leg The external Side of this Extremity has rough irregular ſemilunar Cavity formed in it for receiving the inferior Extremity of th *Fibula*. The poſterior Side has two latera Grooves, and a ſmall Middle Protuberance In the internal Depreſſion, the Tendon of th *Muſculus tibialis poſticus* is lodged; and in th external, the Tendon of the *Flexor longus digitorum* plays. From the Middle Protuberance ligamentous Sheaths go out for tyin down theſe Tendons.

Articulation.

The Articulations and Motions of the *Tibia* ſhall be explained, after all the three Bones of th Leg are deſcribed.

Of Children.

The two Extremities of the *Tibia* are Cartilages at the Birth, an become afterwards *Epiphyſes*.

Fibula.

FIBULA * is the ſmall lon Bone, placed on the Outſide of th Leg, oppoſite to the external Angl of the *Tibia*; the Shape of it is irregularly triangular.

Superior Extremity.

The ſuperior Head of the *Fibul* has a ſuperficial circular Cavit formed on its Inſide, which in recent Subject is covered with

Car

(*a*) Expoſition anatomique des Os ſecs, § 865.

* Παρακνήμιον, perone, Focile minus, arundo minor canna minor cruris, ſura, radius.

Cartilage, but ſo cloſely connected to the *Tibia* by Ligaments, as to allow only a ſmall Motion backwards and forewards. This Head is protuberant and rough on its Outſide, where the *Muſculus Biceps* is inſerted; and below its internal poſterior Side, a Tubercle may be remarked, that gives Riſe to the ſtrong tendinous Part of the *Solæus* Muſcle.

Body.

The Body of this Bone is a little crooked inwards and backwards, which Figure is owing to the Actions of the Muſcles; but is ſtill increaſed to a Fault by careleſs Nurſes holding Children by the Legs. The ſharpeſt Angle of the *Fibula* is anterior; on each Side of which, the Bone is conſiderably but unequally depreſſed by the Bellies of the ſeveral Muſcles that riſe from or act upon it; and in old People theſe Muſcles make diſtinct Sinuoſities for themſelves: For the poſterior Surface is flatned above by the *Solæus*, and is made hollow below by the *Flexor pollicis longus*. The external Surface of this Bone is depreſſed obliquely from above downwards and backwards by the two *Peronæi*; and the anterior Surface bears the Prints of the *Extenſor digitorum longus*, *Nonus Veſalii* and *Extenſor pollicis longus*. From the internal Angle the ſtrong Ligament is produced to be continued to the *Tibia* for the Connexion of theſe two Bones and Origin of ſeveral Muſcles. The poſterior Surface is the plaineſt and ſmootheſt: In the Middle of it the Paſſage of the medullary Veſſels is ſeen ſlanting downwards. I have been particular in remarking with *Havers* (a),

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(a) Oſteolog. nov. Diſc. 1.

the Entry and Direction of theſe Veſſels, b
cauſe in ſeveral chirurgical Caſes, the Oper
tor had Need to take Care, that they are n
opened very near to the Bone, to occaſion a
obſtinate *Hemorrhagy*. And then there ſeems t
be ſome particular Deſign in contriving the
Canals, ſo that the *Os humeri*, *Tibia* and *F*
bula ſhould have them running oblique
down; whereas the *Radius*, *Ulna* and *Os f*
moris have them ſlanting upwards, whereb
the Arteries and Nerves, which are ſent
theſe three laſt Bones, muſt ſuffer a conſide
able Reflexion before they come at the *Can*
celli. The Reaſon of this Diverſity may pe
haps be, that the Arteries particularly whi
are ſo ſmall within the Bones as to have n
ſtrong contractile propelling Force in th
Coats, and where they are not aſſiſted by t
Action of any moving neighbouring Orga
ſhould have, at leaſt in their Paſſage throu
the Bone, a favourable Deſcent for their L
quids; which, it is evident, they will have in t
deſcending oblique Paſſages formed for the
in the firſt claſs of Bones, which are gener
ly depending; and they will alſo moſt f
quently acquire the like Advantage in the l
named Bones, becauſe the Hand in the m
natural Poſture is higher than the Elbow; a
when we ſit or ly, the inferior Extremity
the Thigh-bone comes to be at leaſt as hi
raiſed as the ſuperior. In ſtanding and wal
ing, or when the Arms are moved, the Blo
muſt indeed aſcend as it paſſes thro' the Bo
of the Fore-arm and Thigh; but the Preſſ
of the Muſcles, then in Action, on the Veſſ

before they enter the Bones, is ſufficient to compenſate the Diſadvantage of their Courſe. This Reaſoning ſeems to be ſtill enforced by obſerving, that this Paſſage is always in theſe Bones nearer the ſuperior than the inferior Extremities.

Inferior Extremity.

The inferior Extremity of the *Fibula* is extended into a ſpongy oblong Head, on the Inſide of which is a convex, irregular, and frequently a ſcabrous Surface, that is received by the external Hollow of the *Tibia*, and ſo firmly joined to it by a very thin intermediate Cartilage and ſtrong Ligaments, that it ſcarce can move. Below this, the Extremity of the *Fibula* is ſtretched out into a coronoid Proceſs, that is ſmooth, covered with a Cartilage, and contiguous to the Outſide of the firſt Bone of the Foot, the *Aſtragalus*, to ſecure the Articulation on that Side. This Proceſs is named *Malleolus externus*. This Proceſs being ſituated farther back than the internal *Malleolus*, and in an oblique Direction, obliges us naturally to turn the Fore-part of the Foot outwards, as is obſerved by *Winſlow (a)*. At its inferior internal Part a ſpongy Cavity for mucilaginous Glands may be remarked; from its Point Ligaments go out to the Foot, and on the back Part of it is a Sinuoſity, made by the Tendons of the *Peronæi* Muſcles.

Connexion.

The Conjunction of the ſuperior Extremity with the *Tibia* is by *Arthrodia*, and at the lower End the

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(a) Memoires de l'Acad. des Sciences 1722.

Cartilage ſeems to glew the two Bones tog ther, not however ſo firmly in young Peopl but that the Motion, at the other Extremity ſuch a long *Radius* as the *Fibula*, is very obſe vable. In old Subjects I often ſee the tw Bones of the Leg grown together at their inf rior Extremities.

Uſes. The principal Uſe of this Bone is afford Origin and Inſertion to Mu cles, the Direction of which may be little altered on proper Occaſions, by its u per Part ſhuffling backwards and forwards. likewiſe helps to make the Articulation of th Foot more ſecure and firm.

Of Children. Both Extremities of this Bone ar cartilaginous in a ripe Child, an aſſume the Form of *Appendices* b fore they are united to the Body of the *Fibula*

Rotula. *ROTULA* * is the ſmall fl Bone ſituated at the anterior Part the Joint of the Knee. Its Shape re ſembles much the Section of a Heart with i Point downwards. The anterior convex Su face of the *Rotula* is pretty ſmooth; only ſev ral Holes pierce it, into which Fibres of th ſtrong Ligament that is ſpread over it ente The poſterior Surface is ſmooth, covered wit a Cartilage, and divided by a middle conve Ridge into two Cavities, of which the extern is largeſt; and both are exactly adapted to th Pulley of the *Os femoris*. This plain ſmoot Surface is ſurrounded by a rough promine Edge, to which the circular Ligament adhere

An

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* Ἐπιμυλὶς, μυλακρὶς, κόγχος, ἐπιγονατὶς, πλ γησίεδρον, patella, mola, genu, ſcuti-forme os, cartil ginoſum, diſciforme, oculus genu.

And below them, the Point of the Bone is ſcabrous, where the ſtrong tendinous Ligament from the Tubercle of the *Tibia* is fixed. The ſuperior horizontal Part of this Bone is flatned and unequal, where the Tendons of the Extenſors of the Leg are inſerted.

Subſtance.

The Subſtance of the *Rotula* is cellular, with very thin external firm Plates; but then theſe *Cellulæ* are ſo ſmall, and ſuch a Quantity of Bone is employed in the Formation of this Bone, that ſcarce any Bone of its Bulk is ſo ſtrong. Beſides, it is all covered over with a thick Ligament, (as was obſerved this ſort of Bones generally is,) to connect its Subſtance, and is movable to one Side or other; and therefore is ſufficiently ſtrong, to reſiſt the Actions of the large Muſcles that are inſerted into it, or any common external Force applied to it; while a fixed Proceſs, ſuch as the *Olecranon*, would not have been ſufficient to bear the whole Weight of our Bodies falling on it, as frequently happens to this Bone, and muſt have hindred the rotatory Motion of the Leg. Notwithſtanding theſe Precautions to preſerve this Bone from ſuch Injuries, yet I have ſeen ſuch another Caſe as *Ruyſch (a)* mentions, to wit, a tranſverſe Fracture in this Bone, when by the Report of the Patient, and People about him, and by the want of Swelling, Diſcolouring, or other Mark of Bruiſe or Contuſion, it was plain the Bone was broke by the violent ſtraining Effort of the Muſcles. Tho' my Patient recovered the Uſe of the Joint of the Knee, yet

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(*a*) Obſerv. Anat. Chirurg. Obſ. 3.

yet I think it reaſonable to believe, that th
ſort of Fracture ſhould be attended with a Di
ficulty of Motion, after the broken Parts o
the *Rotula* are reunited, becauſe the callou
Matter will probably extend itſelf into the Ca
vity of the Joint, where it may either grow
to ſome of the Parts, or at beſt it will mak
ſuch an Inequality on the poſterior Surface o
this Bone, as will not allow it to perform th
neceſſary Motions on the Condyles of the *Fe*
mur.

Articulation. The Articulation of the *Rotul*
with the *Os femoris* is a plain *Gin*
glymus, and it is connected to th
Tibia by a ſtrong *Syndeſmoſis*.

Of Infants. At the ordinary time of Birth th
Rotula is entirely cartilaginous, an
ſcarce aſſumes a bony Nature ſ
ſoon as moſt *Epiphyſes* do.

Motion of the Leg. Now therefore that all th
Parts of the Joint of the Kne
are deſcribed, let us examin
what are its Motions, and how performed
The two principal Motions are Flexion an
Extenſion. In the former of theſe, the Le
may be brought to a very acute Angle with th
Thigh, by the Condyles of the Thigh-bone
being round and ſmoothed ſo far backwards
In performing this, the *Rotula* is pulled dow
by the *Tibia*. When the Leg is to be exten
ded, the *Rotula* is drawn upwards, and con
ſequently the *Tibia* forwards, by the Extenſor
muſcles, which by means of the protuberan
Joint and this thick Bone with its Ligament
have in effect the Chord with which they act
fixed to the *Tibia* at a conſiderable Angle

therefore act with Advantage; but are reſtrained from pulling the Leg farther than to a ſtraight Line with the Thigh, by the poſterior croſs Ligament, that the Body might be ſupported by a firm perpendicular Column: For at this time the Thigh and Leg are as little movable as if they were one continued Bone. But when the Joint is a little bended, the *Rotula* is not tightly braced, and the poſterior Ligament is relaxed; therefore, conſidering the ſuperficial Cavities of the *Tibia*, this Bone may be moved a little to either Side, or with a ſmall Rotation; which *Winſlow* (a) juſtly remarks is done by the Motion of the external Cavity backwards and forwards on the internal, which ſerves as a ſort of Axis. Seeing then one Part of the croſs Ligament is ſituated perpendicularly, and the poſterior Part is ſtretched obliquely from the internal Condyle of the Thigh outwards, that poſterior Part of the croſs Ligament will prevent the Leg's being turned at all inwards; but it could not hinder it from turning outwards almoſt round, was not that Motion confined by the lateral Ligaments of this Joint, which can yield no great Way. This Rotation of the Leg outwards is of good Advantage to us in croſſing our Legs on ſeveral neceſſary Occaſions, tho' it is altogether fit this Motion ſhould not be very large, leſt Luxations ſhould frequently have happened here. While all theſe Motions are performing, the only Part of the *Tibia* that moves immediately on the Condyles is only ſo much

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(a) Expoſition Anatomique du corps humain, traité des Os ſecs, § 976.

as is within the cartilaginous Rings, which b their Thickneſs on their Outſides make th Cavities of the *Tibia* more horizontal, by raiſing their external Side where the Surface o the *Tibia* ſlants downwards. By this Mean the Motions of this Joint are more equal an ſteady than otherwiſe they would have been The Cartilages being capable of changing little their Situation fits them for doing thi good Office in the different Motions and Poſtures of the Member, and likewiſe contributes to make the Motions larger and quicker Here then is a farther Proof of the general Rul laid down about movable intervening Cartilages in the Deſcription of the lower Jaw.

Foot.

The *FOOT* is divided, as well a the Hand, into three Parts, *viz. Tarſus*, *Metatarſus* and *Toes*; in the Deſcription of which, the ſeveral Surfaces ſhall be named according to the natural Situatio *viz.* the Broad of the Foot ſuperior, the Sol inferior, the Side of the Great Toe interna the Little Toe external.

Tarſus.

The *Tarſus* * conſiſts of ſeven ſpongy Bones; of which the *Aſtragalus* i the ſuperior, the *Os calcis* poſterior the *Os naviculare* in the Middle, the *Os cuboides* the external of the four anterior; *Os cuneiforme externum*, *medium* and *internum*, follow in reckoning inwards. That the Deſcription of theſe Bones may not be ſwelled with Repetitions, I deſire once for all to obſerve That where-ever a rough Ridge is mentioned without a particular Uſe aſſigned, a Ligamen

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[*] Raſſeta.

s underſtood to be fixed to it; or where-ever a ſpungy rough Cavity, Depreſſion or *Foſſa* is remarked, without naming its Uſe, a Ligament is inſerted, and mucilaginous Glands are lodged: For ſuch will occur in the Detail of each of theſe Bones.

Aſtragalus.

Aſtragalus * is in its ſuperior Part formed into a large ſmooth Head †, which in the Middle is ſlightly hollowed, and therefore reſembles a ſuperficial Pulley, by which it is fitted to the inferior Extremity of the *Tibia*. The internal Side of this Head is flat and ſmooth, to play on the internal *Malleolus*; and the external Side has alſo ſuch a Surface, but larger, for its Articulation with the external *Malleolus*. Round the Baſe of this Head is a rough *Foſſa*; and immediately before the Head, as alſo below its internal ſmooth Surface, we find a conſiderable rough Cavity.

The inferior Surface of the *Aſtragalus* is divided by an irregular deep rough *Foſſa*, which at its interior Extremity is narrow, but gradually widens as it ſtretches obliquely outwards and forwards. The ſmooth Surface behind this *Foſſa* is large, oblong, extended in the ſame oblique Situation with the *Foſſa*; and concave, for its Conjunction with the *Os calcis*. The poſterior Edge of this Cavity is produced into two ſharp pointed rough Proceſſes, between which is a Depreſſion made by the Tendon of the *Flexor pollicis longus*. The inferior Surface before the *Foſſa* is convex, and compoſed

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* Ἄστριος, Talus, baliſtæ os, malleolus, chaib, qua-
rio, os teſſaræ, claviculæ, nuciforme.

† Τετρώρος.

of three diſtinct ſmooth Plains The poſteri
or longeſt, and the exterior or ſhorteſt, are a
ticulated with the Heel-bone; while the inte
nal, which is the moſt convex of the thre
reſts and moves upon a cartilaginous Lig
ment, that is continued from the *Calcaneum* t
the *Os ſcaphoides*. Without which Ligame
the *Aſtragalus* could not be ſuſtained, bu
would be preſſed out of its Place by the gre
Weight it ſupports, and the other Bones of th
Tarſus would be ſeparated. Nor would
Bone be fit here, becauſe it muſt have bee
thicker than could conveniently be allowed
otherwiſe it would break, and would no
prove ſuch an eaſy bending Baſe, to leſſen th
Shoke which is given to the Body in leaping
running, &c.

The anterior Part of this Bone is formed in
to a convex oblong ſmooth Head, which ſom
call its Proceſs, which is received by the *Os*
naviculare. Round the Root of this Head, e
ſpecially on the ſuperior Surface, a rough *Fo*
ſa may be remarked.

Articulation.

The *Aſtralagus* is articulated a
bove to the *Tibia* and *Fibul*
which together form one Cavit
Tho' this Articulation is a *Ginglymus*, it
however ſo looſe, and the Prominencies o
Cavities ſo ſmall, as to allow Motions in a
Directions. The Flexion and Extenſion a
the moſt conſiderable, the other Motions bein
confined both by the inferior Proceſſes of th
Tibia and *Fibula*, called *Malleoli*, and by th
ſtrong Ligaments which go out from the Point
of theſe Proceſſes to the *Aſtragalus*. All th
Motions performed at this Joint are more ev

lent in the anterior Part of the Foot, this being he Extremity of the *Radius* of the Circle in which the Motion is made. The *Aſtragalus* s doubly joined: Below, to the *Os calcis*, by he third Species of *Ginglymus:* and before, to he *Os naviculare*, by *Enarthroſis.*

Of Children.

A conſiderable Share of this Bone is oſſified in a new born nfant.

Os calcis.

Calcaneum * is the largeſt Bone of he ſeven, ſituated at the inferior and oſterior Part of the *Tarſus*. Behind, t is formed into a large Knob, commonly caled the *Heel*; the poſterior Surface of which is ough where the *Tendo Achillis* is inſerted into t; and above, it is hollow and ſpongy. Farher forwards, on the ſuperior Surface of the *alcaneum*, is an oblong ſmooth Convexity, dapted to the poſterior Concavity of the *Aragalus:* And beyond this irregular Convexiy a narrow *Foſſa* is ſeen, which divides it from wo ſmall concave ſmooth Surfaces, that are oined to the anterior Part of the *Aſtragalus*. ehind the poſterior of theſe ſmooth Surfaces, which is the largeſt, a ſmall Sinuoſity is made y the Tendon of the *Flexor digitorum longus*; t the anterior Part of which a ſmall rough rotuberance appears, that gives Riſe to the *Muſculus extenſor digitorum brevis.*

The external Side of this Bone is flat, with ſuperficial *Foſſa* running horizontally, in which the Tendon of the *Muſculus peronæus ongus* is lodged. The internal Side of the eel-bone is hollowed, for lodging the Origin

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* Os calcis, πτέρνα, calcar pedis.

of the *Maſſa carnea Jac. Sylvii*, and for t ſafe Paſſage of the Nerves and Arteries. Un der the Side of the internal ſmooth Concavit a particular Groove is made by the Tendon the *Flexor pollicis longus*; and from the thi Protuberance on this internal Side, the cart laginous Ligament that ſupports the *Aſtrag lus*, goes out to the *Os naviculare*; on whic Ligament, and on the Edge of this Bone which it is fixed, the Groove is formed for th Tendon of the *Flexor digitorum profundus*.

The inferior Surface of this Bone is preſſe flat at the Back-part, by the Weight of our Bo dies; and immediately before this Plain ther are two Tubercles, from the internal of whic the *Muſculus abductor pollicis*, and *Flexor dig torum ſublimis*, have their Origin; and the *A ductor minimi digiti* riſes from the externa Before theſe Protuberances this Bone is co cave, for lodging the Flexor-muſcles; and its anterior Extremity we may obſerve a roug Depreſſion, from which the Ligament go out that prevents this Bone to be ſeparated from the *Cuboides*.

The anterior Part of the *Os calcis* is forme into an oblong Pulley-like ſmooth Surfac which is circular at its ſuperior external E tremity, but is pointed below. This ſmoo Surface is fitted to the *Os cuboides*.

Of Children. A large Share of the Heel-bon is oſſified at the ordinary Time Birth, and the large Knob appea afterwards in Form of an *Epiphyſe*.

Os naviculare.

Os naviculare *, ſituated im-nediately before the *Aſtragalus*, s ſomewhat circular. Its poſte-rior Surface is formed into an oblong Conca-vity, for receiving the round anterior Head of he *Aſtragalus*. On the ſuperior Surface is a rough *Foſſa*. Below, the *Os naviculare* is ve-ry unequal and rough, but hollow for the Safe-ty of the Muſcles. On its Inſide is a pretty arge riſing Knob, from which the *Abductor pollicis* takes in part its Origin, and the Ten-don of the *Tibialis poſticus* is inſerted into it: And to it two remarkable Ligaments are fixed; he firſt is the ſtrong one formerly mentioned which ſupports the *Aſtragalus*; the ſecond is tretched from this Bone obliquely croſs the Foot, to the metatarſal Bones of the middle Toe, and of the Toe next to the little one. On the Outſide of the *Os naviculare* is a ſemi-circular ſmooth Surface, where it is joined to he *Os cuboides*. The anterior Surface of this Bone is all covered with a Cartilage, and di-vided into three ſmooth Plains, fitted to the hree *Oſſa cuneiformia*.

Of Children.

The *Os naviculare* is wholly Cartilage in a new born Infant.

Os cuboides.

OS CUBOIDES † is a ve-y irregular Cube, ſituated im-nediately before the *Os calcis*. The poſterior Surface is an oblong unequal Concavity, adapted to the anterior Part of the *Os calcis*. On the internal Side of this Bone, very ſmall ſemicircular ſmooth Cavity is formed,

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[*] Σκαφοειδὴς, Os cymbæ.

[†] Πολύμοςφον, cubiforme, quadratum, grandinoſum rium, teſſaræ, multiforme.

formed, to join the *Os naviculare*; immediat
ly before which, an oblong ſmooth Plain
made by the *Os cuneiforme externum*; and b
low this, the Bone is hollow and rough. O
the internal Side of the inferior Surface,
round Protuberance and *Foſſa* are found, whe
the *Adductor pollicis* has its Origin. On t
external Side of this ſame Surface is a rou
Knob, covered with a Cartilage; immediate
before which, a ſmooth *Foſſa* may be obſerve
in which the Tendon of the *Peronæus prim*
runs obliquely croſs the Foot; and on t
Knob, the thin flat Cartilage proper to t
Muſcle plays; in place of which ſometimes
Bone is found: More externally than t
Knob, a rough Hollow is made, for the ſtro
Ligament ſtretched betwixt this Bone and
Os calcis. The anterior Surface of the *Os*
boides is flat, ſmooth and ſlightly divided in
two Plains, for ſuſtaining the *Os metatarſi*
the Little Toe, and of the Toe next to it.

At the Birth.

The Oſſification of this Bone
ſcarce begun at the Birth.

Os cuneiforme externum.

Os cuneiforme externum *, if
regard its Situation, or *medi*
by its Bulk, is much of the Sha
of a Wedge, being broad and
above, with long Sides running obliqu
down, and terminating in a ſharp Edge. T
ſuperior Surface of this Bone is an oblo
Square. The poſterior is a ſmooth Triang
which is not complete at the inferior An
and is joined to the *Os naviculare* The
ternal Side is divided as it were by a Diago

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* Chalcoideum externum.

the ſuperior poſterior Half of which is ſmooth, for its Conjunction with the *Os cuboides*, and the other is a ſcabrous Hollow. In the ſuperior anterior Angle of this Surface, a ſmall ſmooth Impreſſion is made by the *Os metatarſi* of the Toe next the Little one. The internal Side of this Bone has both the anterior and poſterior Edges made flat and ſmooth, the firſt by the *Os metatarſi* of the Toe next the Great one, and the laſt by the *Os cuneiforme medium.* The anterior Surface is exactly an oblong Triangle, for ſuſtaining the *Os metatarſi* of the middle Toe.

Os cuneiforme medium.

Os cuneiforme medium, or *minimum*, is ſtill more exactly the Shape of a Wedge than the former. Its internal Side has a flat ſmooth Surface above and behind, for its Conjunction with the following Bone; with a ſmall rough *Foſſa* below; and a conſiderable Share of it is rough and hollow. The external Side is ſmooth, and a little hollowed, where it is contiguous to the laſt deſcribed Bone. Both anterior and poſterior Surfaces are flat, ſmooth and triangular for its Articulation with the *Os naviculare* behind, and with the *Os metatarſi* of the Toe next the great one before.

Os cuneiforme maximum.

Os cuneiforme maximum, or *internum*, differs from the two former in its Situation, which is more oblique. Beſides, the broad thick Part is placed below, and the ſmall thin Point above and outwards; while the inferior broad Surface is concave, for allowing a ſafe Paſſage to the Flexors of the great Toe. The poſterior Surface of this *Os cuneiforme* is hollow, ſmooth, and of a circular Figure belo but pointed above. The external Side is al ſmooth and flat, but divided into two, who Direction is near at right Angles with each ther. With the poſterior, that runs oblique from below forwards and upwards, the *Os cu* *neiforme minimum* is joined; and with the an terior, whoſe Direction is longitudinal, th *Os metatarſi* of the Toe next the great One connected. The anterior Surface of this Bo is ſemilunar, but flat and ſmooth, for ſuſtai ing the *Os metatarſi* of the great Toe. T internal Side is ſcabrous, with two remar able Tubercles below, from which the *Mu* *culus abductor pollicis* riſes; and the *Tibialis an* *ticus* is inſerted into its ſuperior Part.

At the Birth. The three cuneiform Bones a all in a cartilaginous State in *Fœtus* of nine Months.

Uſes. Theſe ſeven Bones of the *Tarſus*, wh conjoined, are convex above, and lea a Concavity below, for lodging ſafe the ſeveral Muſcles, Tendons and Veſſels th ly in the Sole of the Foot, and are, in t ſame Manner as thoſe of the *Carpus*, a (except ſome few Parts mentioned in the particular Deſcriptions) covered over wi ſtrong Ligaments, that, by entring the Hol on their Surface, adhere firmly to them and therefore ſo tightly connect them to ea other, that, notwithſtanding the many ſmoo Surfaces they have all covered with Cartilag and ſome of them of the ſame Shape as if d ſigned for a very movable Articulation, n more Motion is here allowed, than only prevent too great a Shoke of the Fabrick of th

Body in walking, leaping, &c. by falling on oo ſolid a Baſe; which, if it was one continued Bone, would likewiſe be much more liable to be broke; and to make our Foot accommodate itſelf to the Surfaces we tread on, by becoming more or leſs hollow, or by raiing either Side. When the Ligaments are oo weak, as in ſome morbid Caſes, a very evident Motion of the *Os naviculare* on the *Aſtragalus* may be obſerved.

Oſſa metatarſi.

METATARSUS * is compoſed of five Bones, which n their general Characters agree with the metacarpal Bones, but may be diſtinguiſhed from them by the following Marks. 1. They are longer, thicker and ſtronger. 2. Their anterior round Extremities are not ſo broad, and are leſs in proportion to their Baſes. 3. Their Bodies are ſharper above, and flatter on the Sides, with their inferior Ridge inclined more to the Outſide. 4. The Tubercles at the inferior Roots of the round Heads are larger.

The firſt or internal metatarſal Bone is eaſily diſtinguiſhed from the reſt by its Thickneſs. The one next to it is the longeſt, and with its ſharp Edges almoſt perpendicular; and the others are ſhorter and more oblique, as their Situation is more external: Which general Remarks, with the Deſcription I am now to give of each, may learn us to diſtinguiſh what Bone, and of which Foot any one is, that can be offered to our Examination.

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* Στῆθος, πεδίον. Planta, planum, veſtigium, ſolium, pectus, præcordium, pectuſculum.

Os Metatarſi Pollicis is by far th *Pollicis.* thickeſt and ſtrongeſt, as having muc the greateſt Weight to ſuſtain. It Baſe is oblong, irregularly concave, aud of ſemilunar Figure, to be adapted to the *Os cuneiforme maximum*. The inferior Edge of th Baſe is a little prominent and rough, wher the Tendon of the *Peronæus primus* Muſcle i inſerted. On its Outſide an oblique circula Depreſſion is made by the following Bone. It round Head has generally on its Fore-part middle Ridge, and two oblong Cavities, fo the *Oſſa ſeſamoidea*; and on the external Side Depreſſion is made by the following Bone.

Os metatarſi of the ſecond Toe *2di digiti.* the longeſt of the five, with a triangular Baſe, ſupported by the *Os cuneiforme medium*, and the external Side produced into a Proceſs, whoſe Extremity is a oblique ſmooth Plain, to be joined to the *O cuneiforme externum*. Near the internal Edg of the Baſe this Bone has two ſmall Depreſſions, made by the *Os cuneiforme maximum* between which is a rough Cavity. Farthe forwards we may obſerve a ſmooth Protuberance, which is joined to the foregoing Bon On the Outſide of the Baſe are two oblon ſmooth Surfaces, for its Articulation with th following Bone; the ſuperior ſmooth Surfac being extended longitudinally, and the inferio perpendicularly; between which is a roug *Foſſa.*

Os metatarſi of the middle To *Medii digiti.* is the ſecond in Length. Its Baſe ſupported by the *Os cuneiforme externum*, is triangular, but ſlanting outwards

wher

where it ends in a ſharp pointed little Proceſs; and the inferior Angle is not completed.

The internal Side of this Baſe is adapted to the preceding Bone; and the external Side has alſo two ſmooth Surfaces covered with Cartilage, but of a different Figure; for the ſuperior is concave, and being round behind, turns ſmaller as it advances forwards; and the little inferior ſmooth Surface is convex, and very near the Edge of the Baſe.

4ti digiti.

Os metatarſi of the fourth Toe is near as long as the former, with a triangular ſlanting Baſe joined to the *Os cuboides*, and made round at its external Angle, with one hollow ſmooth Surface on the Outſide, where it is preſſed on by the following Bone, and with two on the internal Side, correſponding to the former Bone; behind which, is a long narrow Surface impreſſed by the *Os cuneiforme externum.*

Minimi digiti.

Os metatarſi of the little Toe is the ſhorteſt, ſituated with its two flat Sides above and below, and with the Ridges laterally. The Baſe of it, Part of which reſts on the *Os cuboides*, is very large, tuberous, and produced into a long pointed Proceſs externally; whence Part of the *Abductor minimi digiti* has its Origin; and into its ſuperior Part the *Peronæus ſecundus* is inſerted. Its Inſide has a flat conoidal Surface, where it is adjoining to the preceding Bone.

Uſes.

When we ſtand, the anterior Extremities of theſe metatarſal Bones, and the *Os calcis*, are our only Supporters, and therefore it is neceſſary they ſhould be ſtrong,

and

and have a confined Motion, as indeed we ſee they have.

Toes. The Bones of the *TOES* are much of kin to thoſe of the Thumb and Fingers: Particularly the two of the great Toe are preciſely formed as the two laſt of the Thumb; only their Poſition, in reſpect of the other Toes, is not oblique, and they are proportionally much ſtronger, becauſe they are ſubjected to a greater Force; for on thoſe principally the Weight of the Body is ſupported, when we are raiſed on our Tip-toes.

The three Bones in each of the other four differ from thoſe of the Fingers, in theſe Particulars. They are leſs, and ſmaller in Proportion to their Lengths: Their Baſes are much larger than the anterior Extremity: Their Bodies are ſharper above and below, and flatter on the Sides: The firſt *Phalanx* is proportionally much longer than the ſecond and third, which are very ſhort.

Of the four, the Toe next the great one, has the largeſt Bones in all Dimenſions, and more externally the Toes are leſs. The little Toe, and frequently that next to it, have the ſecond and third Bones intimately united into one, which may be owing to their little Motion, and the great Preſſure they are ſubjected to.

Uſes. The Toes are of good Uſe to us in Walking, by ſerving as Supporters to the Foot behind, when the Sole is raiſed, in order to bring our Body, with its Centre of Gravity perpendicular to the advanced Foot.

In Children. The Bones of the *Metatarſus* and Toes, are in the ſame Condition

in

n Children as thoſe of the *Metacarpus* and Fingers.

The only Bones now remaining to complete the Deſcription of the Skeleton, are the ſmall ones, which are found in the Hand, Foot, and ſome other Parts.

Oſſa ſeſamoidea.

OSSA SESAMOIDEA, are the little Bones moſt frequently found at the Articulations of the Toes and Fingers, which tho' generally ſaid to reſemble the Seed of the *Seſamum*, are of very different Figures and Magnitudes. After the Diſſection of ſeveral of them in recent Subjects, they ſeem to me nothing elſe than the Ligaments of the Articulations or the firm Tendons of ſtrong Muſcles, or both, become bony, by the violent Compreſſion they ſuffer in the Situation they are. Thus the *Seſamoid* Bones at the Beginning of the *Gaſtrocnemii* Muſcles, are evidently compoſed of the tendinous Fibres only. Theſe at the firſt Joint of the great Toe are as plainly the ſame continued Subſtance with the Ligaments and Tendons of the *Abductor*, *flexor brevis*, and *Adductor*, and that, which is ſometimes double at the ſecond Joint of that Toe, is Part of the circular Ligament; and indeed if it was worth while to enumerate all of them that are at any Time found, we would obſerve the whole of them formed in this Manner. Their Number, Figure, Situation and Magnitude are ſo uncertain, that it were in vain to inſiſt on the Differences of each; and therefore, I ſhall only in general remark,

1. That wherever the Tendons and Ligaments are firmeſt, the Actions of the Muſcles

ſtrongeſt, and Compreſſion greateſt, there ſuc Bones will be moſt probably found.

2. That, *cæteris paribus*, the older the Subject is in which they are ſought, their Number will be greater, and Size bigger.

3. The more Labour of either, or both Extremities any Perſon is inured to, he will, *cæteris paribus*, have the moſt numerous an largeſt *Oſſa ſeſamoidea.*

However, as the two at the firſt Joint of th great Toe, are much larger than any othe and are ſeldom wanting in an Adult, we ma judge, that beſides the more forcible Cauſe c their Formation, there ſhould alſo be ſome particular Advantage neceſſary at this Place, rather than elſewhere, which may poſſibly be to allow the *Flexor* Muſcles to ſend thei Tendons along this Joint, ſecure from Compreſſion in the Hollow between the two oblong ſeſamoid Bones, while by removing thei Tendons from the Centre of Motion, and giving them the Advantage of an Angle at thei Inſertion, the Force of the Mucles is increaſed, and therefore the great ſuperincumben Weight of our Body in Progreſſion is mor eaſily raiſed.

A P

APPENDIX.

Of the Marks of a Female Skeleton.

TO finiſh the Deſcription of the Bones is generally to conclude the *Oſteology*, but, hat no Part of this Subject might be left unouched, I think it neceſſary to ſubjoin the diſtinguiſhing Marks of the Male and Female Skeletons, and have choſen to illuſtrate them n the latter; becauſe, as the Fair Sex have a more delicate Conſtitution, and are obliged o afford Lodging and Nouriſhment to their ender *Fœtus*'s till they come to have ſufficient Strength and Firmneſs to bear the Injuries of he Atmoſphere, and Contact of other more ſolid Subſtances: For theſe Reaſons, I ſay, he Bones of Women are frequently incomplete, and always of a Make in ſome Parts of he Body different from thoſe of the robuſt Male, which agree to the Deſcription already delivered, unleſs where the proper Specialities of the Female were particularly remarked, which could not be done in all Places where they occur, without perplexing the Order o this Treatiſe: Therefore I choſe rather t ſum them up here by Way of *Appendix*.

The Cauſes of the following Specialities o the Female Bones, may be reduced to the three. 1. A weak lax Conſtitution. 2. A ſedentary unactive Life, encreaſing that Conſtitution. 3. A proper Frame for being Mothers.

The Bones of Women are ſmaller in Proportion to their Length than thoſe of Men becauſe the Force of their Muſcles is not ſ great, nor is ſuch ſtrong external Force applied to them to prevent their ſtretching out i Length.

The Depreſſions, Ridges, ſcabrous Surface and other Inequalities made by the Muſcle are not ſo conſpicuous in them, becauſe the Muſcles are neither ſo thick nor ſtrong, or ſ much employed to make ſo ſtrong Prints o their Bones.

Their *Os frontis* is more frequently divide by a Continuation of the *ſagittal* Suture, whic depends on the firſt and ſecond general Cauſe aſſigned above for the Specialities in the Bones, as will appear after reflecting on th Account given formerly of the Middle internal Spine of this Bone.

Their *Clavicles* are leſs crooked, becauſ their Arms have been leſs forcibly pulled forwards, which in our *European* Women, eſpecially thoſe of Diſtinction, is more hindred b their Garb.

Their *Sternum* is more raiſed by long Cartilages below, that the *Thorax* might be then widned in ſome Proportion to what it is ſhort

ne

ned by the Preſſure upon the *Diaphragm* when hey are with Child.

The Defect of Bone, or the Hole in the Middle of the *Sternum*, is oftneſt found in hem, to allow the Paſſage of the Mammary Veſſels, ſay ſome; but in my Opinion, this is owing to a lax Conſtitution, by which the Oſſification is not ſo ſoon completed, as where he Action of the Solids is vigorous, and the Circulation of the Fluids is briſk; for a much ſmaller Hole might have ſerved this Purpoſe; and the Branches of the internal Mammary Veſſels which are ſent to the exterior Parts of he *Thorax*, paſs out between the Cartilages of the Ribs before theſe are joined to the *Sternum*.

The *Cartilago Xiphoides*, is oftner bifurcated in Women than Men, for the Reaſon aſſigned in the preceding Paragraph, *viz.* a leſs forcible Power of Oſſification.

The ſuperior Cartilages of the Ribs ſooner oſſify to ſupport the Weight of the *Mammæ*.

The middle Cartilages are more flat and broad by the Weight of the Breaſts.

The inferior Cartilages are longer for enlarging the Cheſt.

The *Os ſacrum* is more turned outwards for enlarging the *Pelvis*.

Weakly Women, who have born many Children when young, often have the *Vertebræ* of their Back bended forwards, and their *Sternum* depreſſed, or become as *Cheſelden* (a) juſtly obſerves, round ſhouldered and flat breaſted by the Preſſure and Weight of the im-

---

(a) Anatomy Book 1, Chap. 3.

impregnated *Uterus*, and by the ſtrong Act
on of the Abdominal Muſcles.

The *Os Coccygis* is more moveable, and le
bended forwards, to facilitate the Birth.

The *Oſſa Iliûm* are more hollow and mo
reflected outwards, and conſequently furth
removed from each other, in order to wide
the inferior Part of their *Abdomen*, and to ſu
port better the impregnated *Uterus*.

The Ridge on the upper Part of the *Os pu*
bis is larger in ſuch Women as have bo
Children, being extended by the ſtrong Act
on of the *Muſculi recti abdominis*.

The Cartilage between the two *Oſſa pub*
is thicker, by which the *Pelvis* is more cap
cious.

The conjoined Surfaces of the *Oſſa pub*
and of the *Oſſa innominata* and *ſacrum* a
leſs, that with the ſtraighter *Os ſacrum*,
larger Paſſage might be left for the Excluſi
of the Child in Birth.

The great Tuberoſity of the *Oſſa Iſchiûm*
flatter in Women than Men, becauſe it is mo
preſſed upon in the ſedentary Life which F
males enjoy.

In conſequence of the *Pelvis* of Women b
ing wider, the Articulations of their Thig
bones muſt be farther removed from each
ther; and therefore, as *Albinus* (a) very well r
marks, a larger Space is left for the Procre
tion and Birth of Children. Which Diſtan
of the Thighs, may be one Reaſon why W
men in running generally ſhuffle more fro
one Side to the other than Men, to preſer
t

(a) De Oſſib. § 339.

he Centre of Gravity of their Bodies from fal-ing too far to a Side of the Joint of the Thigh hat ſupports them when the other is raiſed, which would endanger their tumbling to the Ground.

FINIS.

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FINIS.

THE

ANATOMY

OF THE

Human Nerves,

WITH

An Account of the reciprocal Motions of the HEART,

AND

A Deſcription of the HUMAN LACTEAL SAC and DUCT.

By ALEXANDER MONRO, *P. A.*

EDINBURGH,

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PREFACE.

THE firſt Sketch of the following Eſſays was wrote for the Service of a Friend, without any Intention of mine to have been an Author. When they were publiſhed, I was glad of the Opportunity which the ſecond Edition of the Anatomy of the Bones gave me to correct them, and I thought Mr. Winſlow's *Anatomy* made any further Labour of mine on theſe Subjects unneceſſary. But whenever it was foreſeen that this third Edition of the Oſteology was to be printed, I was teazed with the Importunities of Friends and Scholars, to make the Anatomy of the Nerves more complete, and to tack the other two Eſſays to it. It was in vain for me to plead the Difficulty, if not Impoſſibility of bringing the Phyſiology of the Nerves to any Certainty, tho' it might engage me in an endleſs Diſpute; and that any other Deſcription of the Diſtribution of the Nerves, than what Mr. Winſlow had given, was altogether ſuperfluous: They inſiſted, would not be refuſed, and forced me to undertake it.

In the Account of the Nerves in general, I have avoided what I could to give Offence; and therefore have not only treated all the Opinions I mention with that Modeſty which the Uncertainty of the Subject re-

quired, but have not named one Author, fla tering myſelf, that thoſe, whom I was undi the Neceſſity to redargue, might be better concealed by my not declaring whom I approve

I attempted an accurate Deſcription the particular Nerves; but upon comparing the Notes I wrote of what I ſaw in diſſecting the Nerves with Mr. Winſlow Expoſition des Nerfs, *I found I had don little more than uſed other Words for d ſcribing the ſame Things; and upon givin my Papers to be peruſed by ſome of thoſe f whoſe Uſe any Thing I write is chiefly intended, I mean the Students in Phyſick, diſcovered another Misfortune ſufficient make me alter my Deſign. The young Anatomiſts were ſo confounded with the Variety of Branches and their Sub-diviſion that they could not ſee even the groſs Outlines of the Picture I had attempted draw. That I might be underſtood, and m Scholars might thereby be aſſiſted to remember the more minute Diſſections I ſhou ſhew them, I changed my Notes into a ſuperficial Deſcription of the larger Branch of the Nerves.*

The Account of the Syſtole *and* Diaſto *of the Heart is the immortal* Boerhaave *Doctrine illuſtrated, and the Deſcription the* Receptaculum Chyli, *and of the* Ductus Thoracicus *is nearly the ſame as was in the former Edition.*

THE
ANATOMY
OF THE
Human Nerves.

Of the Nerves in general.

1. BY the Aſſiſtance of Injections and Microſcopes wonderful Plexuſes of Blood-veſſels are diſcovered to go from the *Pia Mater* into the *Cortex*, cineritious, or aſhy-coloured Part of the *Cerebrum*, *Cerebellum* and *ſpinal Marrow*, whereas we can only ſee longitudinal Veſſels, without numerous Ramifications or reticular Plexuſes, in the white medullary Subſtance of theſe Parts.

2. The Continuity of the *Cortex* with the *Medulla* of the *Encephalon* and *ſpinal Marrow* is obſervable with the naked Eye, and is more diſtinctly ſeen with the Aſſiſtance of a Microſcope.

3. In diſſecting the *Brain* and *Cerebellu* we ſee the ſmall Beginnings of the *Medul* proceeding from the *Cortex*, and can trace i gradual Increaſe by the Addition of more *Medulla* coming from the *Cortex*.

4. Both *Cortex* and *Medulla* are very ſucculent; for being expoſed to the Air to dry, they loſe more of their Weight than moſt other Parts of the Body do.

5. In ſeveral Places we can obſerve the *Medulla* to be compoſed of Fibres laid at each other's Sides.

6. The medullary Subſtance is all employed in forming the white fibrous Cords, which have now the Name of *Nerves* appropriated to them. Within the Skull we ſee the Nerves to be the medullary ſubſtance continued, and the *medulla ſpinalis* is all employed in forming Nerves.

7. The common Opinion concerning the Riſe of the Nerves, founded on a ſuperficial Inſpection of thoſe Parts, is, that the Nerves are propagated from the ſame Side of the *Encephalon* at which they go out. But it having been remarked, after a more ſtrict Enquiry, and preparing the Parts by Maceration in Water, that the medullary Fibres decuſſate or croſs each other in ſome Parts of the *Medulla*; as for Example, at the *Corpus annulare*, and Beginning of the *Medulla ſpinalis*: And practical Obſervators having related ſeveral Examples of People, whoſe Brain was hurt on one Side, while the morbid Symptom, Palſy, appeared on the other Side of the Body, of which I have ſeen two Inſtances; and Experiments made on Brutes having confirmed theſe

Obſervations, it has been thought, that the Nerves had their Riſe from the Side of the *Encephalon*, oppoſite to their Egreſs from the Skull. It may however ſtill be ſaid, that this laſt Opinion is not fully demonſtrated, becauſe a Decuſſation in ſome few Parts is not a Proof that it obtains univerſally; and if there are Examples of Palſy of the Side oppoſite to where the Leſion of the Brain was, there are alſo others, where the Injury done to the Brain and the Palſy were both on the ſame Side.

8. The Nerves are compoſed of a great many Threads lying parallel, where they come out from the *Medulla*.

This fibrous Texture is evident at the Origin of moſt of the Nerves within the Skull, and in the *Cauda equina* of the *Medulla ſpinalis*, we can divide them into ſuch ſmall Threads, that a very quick-ſighted Eye can ſcarce perceive them; but theſe Threads, when looked at with a Microſcope, appear each to be compoſed of a great Number of ſmaller Threads.

9. How ſmall one of theſe Fibrils of the Nerves is we know not, but when we conſider that every, even the moſt minute Part of the Body is ſenſible, and that this muſt depend on the Nerves (which all conjoined would not make a Cord of an Inch Diameter) being divided into Branches or Filaments to be diſperſed through all theſe minute Parts, we muſt be convinced that the nervous Fibrils are very ſmall. From the Examination of the *minimum viſibile* it is demonſtrated, that each Fibre in the *Retina* of the Eye, or expanded optick Nerve, cannot exceed the Size of the 32400 Part of a Hair.

10. The medullary Subſtance, of whic the nervous Fibrils are compoſed, is very tender, and would not be able to reſiſt the common Force of the circulating Fluids, and othe ſuch Forces to which the Nerves are expoſe within the Bones, were not the *Pia Mater* an *Tunica Arachnoides* continued upon them. Th former giving them Firmneſs and Strength, an the latter furniſhing a cellular Coat to connec the Threads of the Nerves, to let them ly ſo and moiſt, and to ſupport the Veſſels whic go with them.

It is this cellular Subſtance that is diſtende with Air when it is blown through a Blowpipe thruſt into a Nerve, and that makes Nerve appear all ſpungy, after being diſtende with Air till it dries, the proper nervous Fibril ſhriveling ſo in drying as they ſcarce can b obſerved.

11. Theſe Coats, § 10. would not make the Nerves ſtrong enough to bear the ſtretching and Preſſure they are expoſed to in their Courſ to the different Parts of the Body; and therefor as the Nerves are going out at the Holes in the *Cranium* and *Spine*, the *Dura Mater* is cloſel wrapt round them, to collect their diſgregate Fibres into tenſe firm Cords, and that the ſtretching they may be expoſed to may have no Effect to hurt them where they are not ſtrengthned thus by the *Dura Mater*; this ſtrong Membrane is firmly fixed to the Sides of the Holes in the Bones through which they paſs.

12. The nervous Cords thus compoſed of nervous Fibrils, cellular Coat, *Pia* and *Dura Mater*, have ſuch numerous Blood-veſſels beſtowed on them, that after their Arteries only

are injected, the whole Cord can be tinged of the Colour of the injected Liquor; and if the Injection is puſhed too violently, the cellular Subſtance of the Nerves comes to be diſtended with it.

13. A nervous Cord, ſuch as has been juſt now deſcribed, § 12. has very little Elaſticity, compared with other Parts of the Body. When cut out of the Body, it does not become obſervably ſhorter, while the Blood-veſſels contract three Eighths of their Length.

14. In the Courſe which the Nerves have to the ſeveral Parts of the Body, they are generally lodged in a cellular or fatty ſubſtance, and run in the Interſtices of the Muſcles and other active Organs, that ſo they might be little expoſed to the Preſſure which theſe Parts would make upon them, and might be defended from any bad Effects which ſuch Preſſure might otherwiſe produce.

15. The larger Cords of the Nerves divide into Branches in their Diſtribution to the different Parts; the Branches being ſmaller than the Trunk from which they come, and making generally an acute angle where they ſeparate.

16. In ſeveral Places different Nerves unite into one Cord, which is commonly larger than any of the Nerves which form it.

17. Several Nerves, particularly thoſe which are diſtributed to the Bowels, ſuddenly form a hard Knot, conſiderably larger than all the Nerves of which it is made. Theſe Knots were called *Corpora olivaria*, and are now generally named *Ganglions*.

18. The *Ganglions* have much thicker Coats and larger, more numerous Blood-veſſels than

the Nerves, ſo that they appear redder an
more muſcular. On diſſecting the *Ganglion*
Fibres are ſeen running longitudinally in thei
Axes, and other Fibres are derived from thei
Sides in an oblique direction to the longitudinal ones.

19. The Nerves which go out from th
Ganglions are no way remarkably differen
from other Nerves.

20. The Nerves that are ſent to our Organ
of the Senſes loſe there their firm Coats, an
terminate in a pulpy Subſtance. The *optic*
Nerves are expanded into the ſoft tender Web
the *Retinæ*; the *auditory Nerve* has ſcarce th
Conſiſtence of *Mucus* in the *Veſtibulum*, *Cochlea* and *ſemicircular Canals* of each Ear; th
Papillæ of the Noſe, Tongue and Skin are very ſoft.

21. The Nerves of Muſcles can likewiſ
be traced till they loſe their Coats and becom
very ſoft, from which, and what we obſerve
of the ſenſatory Nerves, § 20. there is Reaſo
to conclude, that the muſcular Nerves are alſo pulpy at their Terminations, which we cannot indeed proſecute by Diſſection.

22. It would ſeem neceſſary that the Extremities of the Nerves ſhould continue in thi
ſoft flexible State, (§ 20, 21.) in order to perform their Functions right: For in proportio
as Parts become rigid and firm by Age, or an
other Cauſe, they loſe of their Senſibility, an
the Motions are more difficultly performed.

23. Tho' the Fibres in a nervous Cord are
firmly connected, and frequently differen
Nerves join into one Trunk, or into the ſam
Ganglion, yet the Senſation of each Part of th
Bod

Body is ſo very diſtinct; and we have ſo much the Power of moving the Muſcles ſeparately, that, if the Nerves are principal Agents in theſe two Functions, which I ſhall endeavour to prove they are, we have Reaſon to believe that there is no Union, Confuſion or immediate Communication of the proper nervous Fibrils, but that each Fibre remains diſtinct from its Origin to its Termination.

24. Changes produced any way upon the Coats of the Nerves cannot however miſs to affect the nervous Fibrils. The cellular Subſtance may be too full of Liquor or may not ſupply enough; the Liquor may not be of a due Conſiſtence, or it may be preternaturally obſtructed and collected. The *Pia Mater* may be too tenſe or too lax, as may alſo the *Dura Mater*; their Veſſels may be obſtructed; their proper Nerves may be violently irritated or loſe their Power of acting; and a great many other ſuch Changes may happen which will not only occaſion Diſorders in particular Nerves, but may cauſe the *Sympathy* ſo frequently obſerved among the Nerves, which is ſo neceſſary to be attentively regarded in a great many Diſeaſes in order to diſcover their true State and Nature, without the Knowledge of which we muſt commit very dangerous Miſtakes in the Practice of Phyſick and Surgery.

25. Many Experiments and Obſervations concur in proving, that when Nerves are compreſſed, cut, or any other way deſtroyed, the Parts ſerved by ſuch Nerves farther from the Head or Spine than where the injuring Cauſe has been applied have their Senſations, Motions and Nouriſhment weakned or loſt, while

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no ſuch Effects are ſeen in the Parts neare to the Origins of thoſe Nerves; and in ſuch Experiments where the Cauſe impeding the Nerves to exert themſelves could be removed, and the Structure of the Nerves not injured; as for Example, when a Ligature made upon a Nerve and ſtopping its Influence has been taken away, the Motion and Senſation of the Parts ſoon were reſtored. From which it would appear that the Nerves are principal Inſtruments in our Senſations, Motions and Nouriſhment; and that this Influence of the Nerves is not inherent in them without the Communication between theſe Cords, and their Origin is preſerved.

It will be no Objection to this Concluſion, that ſometimes, upon cutting a Nerve, the Effects above-mentioned have been felt for a ſhort Time, but afterwards the Perſon was ſenſible of no Numneſs or Immobility; for wherever this is ſaid to have happened, the cut Nerve was only one of ſeveral which were ſent to the Member, the want of whoſe Influence would be felt no longer than till the Habit was acquired of performing the Functions eaſily by the other Nerves.

It is of no greater Weight as an Objection, that when a Ligature is drawn very hard upon a Nerve, the Nerve never again recovers its Influence upon the Parts it is diſtributed to beyond the Ligature, but is of as little Effect as if it had been cut thro'; which is to ſay, that its Texture has been alter'd beyond Recovery. The ſame Thing is to be ſeen by tying a Thread tight round a tender Twig of any vegetable, it decays.

26. Experiments and Obſervations ſhew too, that when Parts of the *Encephalon* or *Medulla ſpinalis* have been irritated, compreſſed or deſtroyed, the Parts of the Body, whoſe Nerves had their Origin from ſuch affected Parts of the *Encephalon* or *Medulla ſpinalis*, became convulſed, paralytick, inſenſible or waſted; and in ſuch Caſes where the injuring Cauſe could be removed from the Origin of the Nerves, the morbid Symptoms obſerved in the Parts to which theſe Nerves were diſtributed, went off upon the Removal of that Cauſe. From which it is thought reaſonable to conclude, that the Nerves muſt not only have a Communication with their Origin, but that the Influence they have upon the Parts they are diſtributed to, depends on the Influence which they derive from the *Medulla Encephali* and *ſpinalis*.

27. Tho' the *Medulla ſpinalis* has its own Veſſels and cineritious Subſtance which aſſiſts to form its *Medulla*, yet a very large Share of the Medullary Subſtance within the Spine is derived fiom the *Encephalon*, whoſe *Medulla oblongata* deſcends from the Head, and the Influence of the *Medulla ſpinallis* on its Nerves depends in a great Meaſure on this *Medulla oblongata* of the Head. Hence an Injury done to any Part of the *Medulla ſpinalis* immediately affects all the Parts whoſe Nerves have their Origin below where the injuring Cauſe is applied to the Spinal Marrow. A Luxation of a *Vertebra* in the Loins makes the lower Extremities ſoon paralytick; a tranſverſe Section of the *Medulla* at the firſt *Vertebra* of the Neck ſoon puts an End to Life.

28. If ſuch Cauſes produce conſtantly ſuch Effects (§ 25, 26, 27,) in us and other Creatures living in nearly the ſame Circumſtances as we do, the Concluſions already made will be good, notwithſtanding Examples of Children and other Creatures being born without *Brains* or *Medulla ſpinalis*; or notwithſtanding the Brains of adult Creatures being much changed in their Texture by Diſeaſes, and notwithſtanding the Experiments o cutting off the Heads of *Tortoiſes*, and ſome other Animals which continued to move abou a conſiderable Time after their Heads were off. We may be ignorant of the particular Circumſtances requiſite or neceſſary to the Being or Wellbeing of this or that particular Creature, and we may be unable to accoun for a great many Phænomena; but we muſt believe our Eyes in the Examination of Facts and if we ſee conſtantly ſuch Conſequences from ſuch Actions, we cannot but conclude the one to be the Cauſe, and the other the Effect. It would be as unjuſt to deny the Concluſions made in the three preceeding Articles, becauſe of the ſeemingly preternatura Phænomena mentioned in the Beginning o this, as it would be to deny the Neceſſity o the Circulation of the Blood in us and Quadrupeds, becauſe a Frog can jump about or a Tortoiſe can walk long after all the Bowels o its Thorax and Abdomen are taken out, or becauſe the different Parts of a Worm crawl after it has heen cut into a great many Pieces It is therefore almoſt univerſally agreed tha the Nerves are principal Inſtruments in ou Senſations, Motion and Nouriſhment, an

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that the Influence which they have is communicated from their Origin, the *Encephalon* and *Medulla ſpinallis*; but Authors are far from agreeing about the Manner in which this Influence is communicated, or in what Way Nerves act to produce theſe Effects.

29. Some alledge that *the nervous Fibres are all ſolid Cords acting by Elaſticity or Vibration.* Others affirm that *thoſe Fibres are ſmall Pipes conveying Liquors, by means of which all their Effects are produced.*

30. The Gentlemen, who think the nervous Fibres ſolid, raiſe ſeveral Objections to the oher Doctrine, which I ſhall conſider afterwards, and endeavour to ſhew the Fitneſs of heir own Doctrine to account for the Effects commonly obſerved to be produced by the Nerves.

The Objects of the Senſes plainly, ſay they, make Impulſes on the Nerves of the proper Organs, which muſt ſhake the nervous Fibrils, and this Vibration muſt be propagated aong the whole Cord to its other Extremity or Origin, as happens in other tenſe Strings; and heſe Vibrations being differently modified according to the Difference of the Object, and its different Application, produce the different deas we have of Objects.

31. To this Account of the Senſations it is bjected, 1*ſt*, That Nerves are unfit for Vibraons, becauſe their Extremities, where Obects are applied to them, are quite ſoft and appy, (§ 20.) and not ſuſceptible of the Vibrations ſuppoſed; and if there could be any ttle Tremor made here by the Impulſe of Obects, it could not be continued along the ner-

vous Cord, becauſe the cellular Subſtance by which each particular Fibre is connected to the neighbouring ones, (§ 10.) and the fatty Subſtance in which the nervous Cord is immerſed (§ 14) would ſoon ſtifle any ſuch vibratory Motion.

The 2*d* Objection to this Doctrine is, that ſuppoſing the Nerves capable of Vibrations by the Impreſſions of Objects, theſe Vibrations would not anſwer the Deſign. For if what we know of other vibrating Strings, to wit that their Tone remains the ſame, unleſs their Texture, Length or Tenſion is altered, and that different Subſtances ſtriking them do no more than make the Sound higher or lower. If theſe Properties are to be applied to Nerves then it will follow that the ſame Nerve would conſtantly convey the ſame Idea, with no other Variety than of its being weaker or stronger, whatever different Objects were applied to it, unleſs we ſuppoſe the Nerve changed in its Texture, Length or Tenſion each Time a different Object is applied, which, it is preſumed, no Body will undertake to prove does happen. But further, if ever ſuch a Variety of Vibrations could be made, our Senſations would notwithſtanding be confuſed and indiſtinct, becauſe the tremulous nervous Fibres being firmly connected, and contiguous to ſeveral other Fibres of the ſame Cord, would neceſſarily ſhake them too, by which we ſhould have the Notion of the Object as applied at all the different Parts where the Extremities of theſe Fibres terminate.

32. In whatever way the Favourers of this Doctrine of ſolid Nerves pleaſe to apply this

Elaſticity of Nerves to the Contraction of Muſcles; their Adverſaries inſiſt that Nerves are too weak to reſiſt ſuch Weights as the Muſcles ſuſtain, they would ſurely break, eſpecially that they are greatly, if not wholly, deprived of their ſtrong Coats before they come to the Part of the Muſcle, they are immediately to act upon (§ 21.) and the Nerves being found to have little or no Elaſticity to ſhorten themſelves (§ 12.) ſhews them altogether unfit for ſuch an Office as this of contracting Muſcles in the way propoſed of their acting by Elaſticity.

33. As a further Objection againſt either Motion or Senſation being owing to the Elaſticity of the Nerves, it is ſaid, that if this Doctrine was true, the Senſations would be more acute, and the Contractions of Muſcles would be greater and ſtronger, when the Parts become firmer and more rigid by Age; for then their Elaſticity is increaſed: Whereas on the contrary it appears, (§ 22.) that then the Senſations are blunted, and muſcular Contraction becomes leſs and weaker.

34. If the Nerves were granted to be elaſtic, and to communicate a ſpringy Force to all the Parts they are diſtributed to, they might appear neceſſary in this View to aſſiſt the Application of the nutritious Particles of the Fluids to the Sides of the Veſſels theſe Particles were to repair; and ſo far might well enough account for the Share Nerves are thought to have in Nutrition; yet if we cannot make uſe of Elaſticity in the other two Functions of Senſation and Motion, we muſt alſo endeavour to find out ſome other Way the

Nerves act in Nutrition, which will be don afterwards.

35. Having thus ſtated the Reaſons for an againſt the Nerves acting as ſolid Strings, l us likewiſe relate the Arguments for Nerve being Pipes, and the Objections to this Do ctrine.

A great Argument of thoſe who think th Nerves to be Tubes conveying Liquors, is th ſtrong Analogy of the Brain and Nerves to o ther Glands of the Body and their Excretorie where a manifeſt Secretion of Liquor is mad in the Glands to be conveyed by the Excre tories, to the proper Places in which it oug to be depoſited: They think that the vaſcul Texture of the Cortex of the *Encephalon* an *Medulla ſpinalis* (§ 1.); the Continuation o the Cortex in forming the medullary Sub ſtance (§ 2. 3.), the fibrous Texture (§ 5.) an ſucculent State of this *Medulla* (§ 4.), and i being wholly employed to form the Nerve (§ 6.), where the fibrous Texture is evide (§ 8.); all theſe Things, ſay they, conſpire ſhew ſuch a ſtrong Analogy between the Parts and the other Glands of the Body, a carries a Conviction that there is a Liquor ſ creted in the *Encephalon* and *Medulla ſpinal* to be ſent out by the Nerves to the differe Parts of the Body.

36. The following Objections are raiſed this Argument in favour of a Liquor conve ed in the Nerves, from the Analogy of th Glands. 1*ſt*, Other Glands, it is ſaid, hav their Excretories collected into a few larg Pipes, and not continued in ſuch a great Num ber of ſeparate Pipes, as far as the Plac

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where the Liquors are depoſited, which laſt muſt be the Caſe, if the Nerves are the Excretories of the glandular Brain. 2*dly*, We ſee the Cavities and can examine the Liquors in the Excretories of other Glands much ſmaller than the Brain, which cannot be done in the Nerves. 3*dly*, If the Nerves were Pipes, they would be ſo ſmall that the Attraction of their Sides to their Liquors would be ſo great, that the Liquors could not be moved with the Celerity required to influence our Senſations and Motions, in the quick Manner we ſee them performed. 4*thly*, If the Nerves were Pipes they would be cylindrical ones, and conſequently not ſubject to Diſeaſes, or at leaſt we could have no Comprehenſion of the Diſeaſes in them.

37. The Anſwer to the 1*ſt* of theſe Objections is, That there are other Glands where there is a manifeſt Secretion, and in which the Diſpoſition of the Excretories is in much the ſame way as in the *Encephalon*; the Kidneys, for Example, have a reticulated Cortex of Veſſels, from which the *Euſtachian* or *Bellinian Medulla*, conſiſting of longitudinal Fibres and a few longitudinal Blood Veſſels, proceeds; and this *Medulla* is collected into ten or twelve *Papillæ*, each of which is formed of numerous ſmall ſeparate Pipes, which ſingly diſcharge the Urine into the large membranous Tubes, which united compoſe the *Pelvis*. Upon comparing this Texture of the Kidney with what was ſaid of the *Encephalon*, (§ 1, 2, 3, 4, 5, 6, 8.) the Analogy will be found very ſtrong.

38. In Anſwer to the 2*d* Objection in § 36.

it is granted, that Microſcopes, Injections, an all the other Arts hitherto employed have no ſhewn the Cavities of the nervous Fibrils, o the Liquors contained in them; and from what was ſaid (§ 9.) of the ſmallneſs of th nervous Fibrils, it is not to be expected tha ever they ſhould be ſeen. But ſo long as ſuch a Number of little Animals can every Hou be brought to the Framers of this Objection in which they can as little demonſtrate the Veſſels or contained Fluids, it will not be allowed to be concluſive Reaſoning, that becauſe ocular Demonſtration cannot be given of Pipes, therefore they do not exiſt. For if we have any Notion of an Animal, it is its being a Hydraulick Machine, which has Liquors moving in it as long as it has Life; if therefore ſuch little Animals have Veſſels and Liquors which we cannot ſee, why may not ſome of the Veſſels and Liquors of the human Body be alſo inviſible to us.

To avoid this Anſwer to the Objection, it is further urged that tho' we might not ſee the Canals and Liquors of Nerves as they are flowing naturally, yet they ought to diſcover themſelves by the Canals being ſtretched, or a Nerve's ſwelling upon being firmly tied; and it might likewiſe be expected, that however ſubtile the Liquor of the Nerves is, it might be collected in ſome Drops at leaſt, when the cut End of a Nerve of a living Animal is kept ſome Time in the exhauſted Receiver of an Air-Pump. It is affirmed, that neither did the tied Nerve ſwell between the Brain and Ligature, nor was there any Liquor collected in the Receiver of the Air-Pump, from which it is concluded that there is no Liquor in the Nerves.

There is ſome Difference among thoſe who ſay they have tried theſe Experiments, ſome affirming that in young Animals the Nerve does ſwell above the Ligature, and that a Liquor does drill out upon cutting a Nerve. But allowing the Experiments to ſucceed any way, the Reply to the Inference from them is, that in neither way are they any thing to the Purpoſe; for the ſwelling of the Nerve after it is tied, or the Efflux of Liquors from its Extremity, will never prove either to be the Effect of the Fluid in the proper nervous Fibrils, ſo long as they might be occaſioned by the Liquors in the larger Veſſels of the cellular Subſtance of the Nerves; and if theſe ſame Veſſels of the Coats of the Nerves do not diſcover their Liquors by theſe Experiments, it is far leſs to be expected that the much more ſubtile Nerves ſhould.

39. The 3*d* Objection to the Doctrine of the Brain being a Gland, and the Nerves its Excretories, ſuppoſes a more rapid Motion neceſſary in the Fluid of the Nerves, than what moſt of the Defenders of the nervous Fluid will now allow, and is afterwards to be conſidered particularly in a more proper Place.

40. The 4*th* Objection being, that if Nerves are Excretories of a Gland, they muſt be cylindrical Pipes, in which no Obſtructions or Diſeaſes would happen; but ſince we daily ſee Diſeaſes in the Nerves, they muſt therefore not be ſuch Excretories. The Anſwer is, That Diſeaſes happen often in the Excretories of other Glands as of the Liver, Kidneys, *&c.*

notwithſtanding their cylindrical Form, an their much ſhorter and leſs expoſed Courſe When we conſider the very tender Subſtanc of the Brain; the vaſt Complication of Veſſel there; the prodigious Smalneſs of the Pipe going out from it; the many moving Power which the Nerves are to undergo the ſhock of; and the many Chances which the Veſſels Membranes and cellular Subſtance accompanying the Nerves have of being diſordered and then affecting the nervous Fibrils, w have very great Reaſon to be ſurprized, tha theſe cylindrical Pipes are not much more frequently put out of Order by too great or too ſmall a Quantity of Liquors; by too viſcid o too thin Fluids; by Liquors conſiſting of too mild and ſluggiſh Particles, or of too acri pungent ones; by too great or too little Motion given to the Liquors; by the Diameter of the Pipes being too much ſtraitned, or too much enlarged; and by a great many other Varieties of Circumſtances which might be ſuppoſed capable of diſturbing the Functions o the Nerves, ſuppoſing them to be cylindrica Excretories of the Gland the Brain.

41. The numerous Veſſels of the *Encephalon* have brought ſome of the Gentlemen wh defend the Opinion of the Nerves being ſolid to acknowledge, that there is a Liquor ſecreted in the Brain; but then they will not allow that this Liquor is ſent out by the prope nervous Fibrils, but that it is poured into th cellular Subſtance in which the Nerves ly, t keep them moiſt and ſupple, and therefore fi for exerting their Elaſticity, Vibration, *&c.*

by which, in their Opinion, the Effects commonly aſcribed to Nerves are produced.

42. Beſides the Objections already mentioned (§ 31, 32,) againſt the Nerves acting as elaſtick Strings, this Opinion has ſome other Difficulties attending it, that may be urged as Objections to it; ſuch as, there is not one Example in the Body of Liquors ſecreted in a large Gland being poured into a cellular Subſtance, as here ſuppoſed; the Liquors in the Cells of the *tunica cellularis* of other Parts are ſeparated from the little Arteries which are diſtributed to theſe Cells.

Further, it can't be well determined, how a Liquor ſecreted in the *Cortex* of the Brain ſhould make its Way through the *Medulla* to come out into the cellular Membranes on the Surface of that *Medulla*.

Laſtly, A very ſimple Experiment of injecting Water by the Artery of any Member, and thereby filling the cellular ſubſtance of the Nerves of that Member, ſhews evidently that the Liquor of the *tunica cellularis* of the Nerves has the ſame Fountain as the Liquor in the *tunica cellularis* has any where elſe, that is, from the little Arteries diſperſed upon it.

43. The Doctrine of a Fluid in the Nerves is not only thus ſupported by the Analogy of the Brain and Nerves to the other Glands and their Excretories, but thoſe who maintain this Doctrine mention an Experiment which they think directly probative of a Fluid in the Nerves; it is this. After opening the Thorax of a living Dog, catch hold of and preſs one or both the phrenic Nerves with the Fingers, the *Diaphragm* immediately ceaſes

to contract; then let go the hold of the Nerves, and the Muſcle acts again: Pinch a ſecond time the Nerve or Nerves ſome way above the *Diaphragm*, this Muſcle again ceaſes to act: Keep firm the Hold of the Nerve, and with the Fingers of the other Hand ſtrip it down from the gripping Fingers towards the *Diaphragm*, and the Muſcle is made to contract; and for three or four ſuch Stripings its Action follows or obeys the Motion of the Fingers which ſtrip it down; then it becomes diſobedient, and will contract no more, ſtrip as you will, unleſs the Fingers gripping or pinching the Nerve let go their Hold, or are removed higher up upon the Nerve, when the Muſcle may again be made to contract by ſtripping the Nerve down towards it. This Experiment I have done with the Succeſs here mentioned. Let any one try if he can imagine any other reaſonable Account of theſe Appearances, than that the gripping Fingers ſtopt the Courſe of a Fluid in the Nerve; that what of this Fluid was thus made to ſtagnate in the Part of the Nerve between the gripping Fingers and *Diaphragm*, was forced down into that Muſcle by the Preſſure of the Fingers which ſtripped the Nerve down; and when ever this ſtagnating Fluid was preſſed all away by ſeveral Repetitions of ſtripping the Nerve, the Muſcle being ſupplied with no more Fluid contracted no more, till upon removing the Fingers which had hold of the Nerve, a new Supply of Liquor was brought from the Brain, or from the Part of the Nerve that had not yet been grip'd or ſtripped; and when ever this Liquor could make its Way down to the Muſcle, or was forced down to it, the Muſcle immediately began to renew its contractile Motions.

44. Some Gentlemen convinced of the Reaſonableneſs of the Secretion of a Liquor in the Brain to be ſent out by the Nerves, but not comprehending how a Fluid could have ſuch a rapid retrograde Motion as they imagined was neceſſary for conveying the Impreſſions of Objects made on the Extremities of Nerves to the *Senſorium*, ſuppoſed two Sorts of Nerves, one that conveyed a Liquor for muſcular Motion and Nutrition; the other compoſed of ſolid Nerves, that were to ſerve for the Organs of the Senſes, to convey the Vibrations communicated from Objects to the *Senſorium*.

45. The Objections mentioned (§ 31.) againſt the ſenſatory Nerves acting by Vibrations take place here: And further, there is nothing in the Texture either of the Brain or Nerves, which gives any Reaſon to think, that the Nerves are differently formed; on the contrary, the Structure is every where ſimilar, and often Branches of the ſame Nerve ſerve both for Senſation and Motion. What occaſioned juſtly a Prejudice againſt the Scheme of our Senſations depending on a Fluid in the Nerves, to wit, the rapid Refluxes ſuppoſed in the ſenſitive Nerves, is an Opinion now deſerted generally by the Defenders of the nervous Fluid, for Reaſons to be given in a little, tho' their Opponents are ſtill willing to palm it on them, whereby they may have a better Handle againſt the general Doctrine of the nervous Fluid.

46. This ſame rapid Reflux it was too, which gave Riſe to another Diviſion of the Nerves into arterious or effluent, and venous or reflu-

ent. It was ſaid, that muſcular Motion and Nutrition depended on the arterious Nerves, and that the Senſations depended on an accelerated Motion of the nervous Fluid towards the Brain, by the Impreſſions which the Objects of the Senſes make upon the venous Nerves. By this Suppoſition the Abſurdity of rapid Fluxes and Refluxes in the ſame Canal was prevented, and an Advantage was thought to be gained by it, of ſaving too great a Waſte of the Fluid of the Nerves, which otherwiſe the *Encephalon* and *Medulla ſpinalis* could not ſupply in ſufficient Quantity to anſwer all the Exigencies of Life.

47. To this Opinion (§ 46.) it has been objected, 1. That there is no Example in the Body of a ſecreted Liquor being returned immediately and unmixed to the Gland by which it was originally ſeparated from the Maſs of Blood, which would be the Caſe were there venous Nerves. 2*dly*, There is no Occaſion for ſaving the Fluid of the Nerves in the Way propoſed, the Organs for ſecreting that Fluid being large enough to ſupply all that is neceſſary of it in the common Functions of Life. 3*dly*, If the Fluid of the Nerves was to be thus kept in a perpetual Circulation, it would ſoon become too acrid for continuing with ſafety in ſuch ſenſible tender Veſſels as the Brain and Nerves are compoſed of. 4*thly*, This Hypotheſis will not anſwer the Deſign for which it was propoſed. For tho' the momentary Application of an Object might cauſe an Acceleration in the Fluid of venous Nerves, yet if the Object was kept applied to the Nerves, it would ſtop their Fluid, ſo that it could not go

forward to the Brain; and therefore, according to this Doctrine, we ſhould be ſenſible of no Objects, except thoſe whoſe Application to the Organs of the Senſes was momentary.

48. Let us now ſuppoſe it probable, that the *Encephalon* and *Medulla ſpinalis* ſecern a Liquor from the Blood which is ſent into all the Nerves, and that by the Means of this Liquor the Nerves perform the Offices commonly aſſigned to them, it is neceſſary to enquire what Kind of Liquor this is, and how it moves, in order to determine how well its Nature and Motion are fitted for performing what is expected from it.

49. It has been ſuppoſed, that the Liquor of the Nerves was of a very ſtrong acid or alcaline Nature; but ſince we can ſee none of our Juices of ſuch Natures, and ſince ſuch Liquors irritate and deſtroy the Parts of the Body they are applied to, we can never imagine that the Brain could ſeparate, or the Nerves could bear any Thing of ſuch an acrid Nature; and this ſame Tenderneſs and Senſibility of theſe Organs muſt hinder us to ſuppoſe the Liquor of the Nerves can be acrid or pungent of any Kind, as of the Nature of inflammable Spirits, Spirit of Harthorn, *&c.*

50. Some have imagined the Liquor of the Nerves to be capable of vaſt Exploſion, like Gunpowder, or of violent ſudden Rarefaction like Air, or of ſtrong Ebullition like boiling Water, or the Mixture of Acids with alkaline Liquors. But as none of the Particles of our Maſs of Blood, from which this Liquor of the Nerves muſt be derived, enjoy any ſuch Properties, we cannot ſuppoſe the Blood to fur-

niſh what it has not. Beſides, all theſe Operations are too violent for the Brain or Nerves to bear; and when once they are begun, are not ſo quickly controuled or put an End to, as Experience teaches us the Nerves can be made to ceaſe from acting.

51. We know not ſufficiently the Properties of an *Æther* pervading every Thing, to pretend to apply it to the animal Functions, eſpecially where we muſt ſuppoſe it ſent a great Way in a long Cord, in which we cannot conceive how it ſhould be confined; which are Difficulties not to be ſurmounted in accounting for the Functions of Nerves by Means of ſuch an *Æther.*

52. The ſureſt Way of judging what Kind of Liquor this of the Nerves muſt be, is to examine the Liquors of ſimilar Parts of the Body. All the Glands ſeparate Liquors from the Blood much thinner than the compound Maſs itſelf; ſuch is the *Liquor* poured into the Cavity of the *Abdomen*, *Thorax*, *Ventricles of the Brain*, the *Saliva*, *pancreatic Juice*, *Lymph*, &c. Wherever there is Occaſion for ſecreted Liquors being thick and viſcid, in order to anſwer better the Uſes they are intended for, Nature has provided Reſervoirs for them to ſtagnate in, where their thinner Parts may be carried off by the numerous abſorbent Veins diſperſed on the Sides of thoſe Cavities, or by flying off where there is a Communication with the external Air. The *Snot of the Noſe* is very thick commonly by ſtagnating; but when the Secretion of the Membrane of the Noſe is increaſed by blowing the Noſe, or by Sternutatories, we ſee it very thin and watry; there is

not then Time for the Air or Abſorbents to carry off the more watry Particles. The *Cerumen* of the Ears is of a watry Conſiſtence, when ſqueezed out before it has ſtagnated. The *Mucus* of the alimentary Canal is concocted in *Lacunæ*. The *Bile* in the hepatick Duct is lymphatick; that in the Gall-bladder is viſcid and ſtrong. The *Urine* is much more watry as it comes from the Kidneys, than when it is excreted from the Bladder. The *Seed* is thin as it comes from the Teſticles, and is concocted in the *Veſiculæ ſeminales*, *&c.*

53. From § 52. we may ſafely conclude, that the Secretion of a thin Liquor is made in the *Cortex* of the *Encephalon* and *Medulla ſpinalis*; and ſeeing the Thinneſs of ſecreted Liquors is generally as the Diviſions of the Veſſels into ſmall ſubtile Branches, and the Ramifications within the Skull are carried on to a very great Subtilty, the Liquor ſecreted in the *Encephalon* may be determined to be among the fineſt or thinneſt Fluids.

54. Seeing we can obſerve no large Reſervoire, where the Liquor ſecerned in the *cortical Subſtance* is depoſited, to have its finer Parts taken off, we have Reaſon to think, that it goes forward into the Nerves in the ſame Condition in which it is ſecerned.

55. By fine or ſubtile animal Liquors is meant no more than thoſe which are very fluid, conſiſting of a large Proportion of watry Particles, and a leſſer one of the oily, ſaline and terreſtrious Particles. Some of the Liquors which we can have in ſufficient Quantity to make Experiments with, are ſo fluid, and have ſo little Viſcidity or Coheſion of Parts,

that when laid on a Piece of clean Mirrour, they will evaporate without leaving a Stain on the Mirrour, ſuch is the Liquor drilling out on the Surface of the Pleura, the Lymph, and ſeveral others.

If then theſe Liquors, which are ſubject to our Examination, the ſecerning Veſſels of which are ſo large that we can ſee them, have ſuch a ſmall Coheſion of Parts, it might not be unreaſonable to ſay, that the Liquor of the Nerves is as much more fine and fluid than Lymph, as the Veſſels ſeparating it are ſmaller; and therefore that the Fluid of the Nerves is a defecated Water with a very ſmall Proportion of *animal Sapo* diſſolved in it.

56. Two Experiments are ſaid to contradict this Opinion of the Liquor of the Nerves being ſo fluid and ſubtile. One is, that upon cutting the *Cauda equina* of a living Animal, a Liquor as viſcid as the White of an Egg drops out: The other is, that a wounded Nerve yields a *glairy Sanies.* But theſe are no Proof that the Liquor of the Nerves is of the ſame Nature, ſince it is evident that the Liquor diſcharged in both theſe Caſes, comes out of the cellular Subſtance involving the nervous Fibrils.

57. Conſidering how many Experiments make it evident, that there is a conſtant uninterrupted Stream of Liquors flowing through all the Canals of Animals, which convey Liquors, whoſe Particles are not larger than the Diameter of their Canal, which never is the Caſe in a natural State of excretory Veſſels, it is ſurprizing how the Opinion ever ſhould have

been taken up of the Liquid of the Nerves being obliged to make ſuch a prodigious rapid Courſe, as to flow from the Brain to each Muſcle inſtantaneouſly when we will to contract it; or that this Liquor ſhould flow back with the like Celerity from the Extremity of each Nerve, to which an Object of Senſation was applied. The Nerves, as well as the other Excretories of the Glands are always full of Liquors, the Degree of Diſtenſion of the Canals by the Liquors being, even in a ſound natural State, ſometimes more, and ſometimes leſs, the Sides of the Tubes being ſtretched to make way for a larger Quantity, and contracting to accommodate themſelves to a leſſer Quantity; as much Liquor as does Violence to the Sides of the Canals in ſtretching, or ſo little as the Sides cannot contract to, both occaſion Diſeaſes.

58. The Motion of the Fluid in the Nerves will not only then be conſtant, but it will alſo be equal, or nearly ſo: For tho' the Blood in the larger Arteries is moved unequally by the unequal Forces, the Contraction of the Ventricle of the Heart, and the weaker Power, the Syſtole of the Arteries, yet the Difference between theſe two moving Powers comes to be leſs and leſs perceptible, as the Arteries divide into ſmaller Branches, becauſe of the numerous Reſiſtances the Liquors meet with, and becauſe the Canals they move in become larger, till in the very ſmall arterious Branches there is no Difference in the Velocity of the Liquors from the Effect of the Heart or Arterie. The Motion of the Fluids muſt ſtill be more equal in the Excretories of Glands,

and

and particularly in thoſe where the Veſſels have divided into very minute Branches. So that the nervous Fluid will move conſtantly, equally and ſlowly for ordinary; but this natural Courſe may be alter'd by the Influence of the Mind, or by the Preſſure of ſome neighbouring active Organ.

59. We have perhaps no Idea of the Manner how Mind and Body act upon each other; but if we allow that the one is affected by the other, and that the Fluid of the Nerves (whatever Name People pleaſe to give it) is a principal Inſtrument which the Mind makes uſe of to influence the Actions of the Body, or to inform itſelf of the Impreſſions made on the Body, we muſt allow that the Mind can direct this Inſtrument differently, particularly as to Quantity and Celerity.

60. Let us now ſuppoſe the nervous Fluid ſuch as has been argued for, to wit, an extreme Fluid ſaponaceous Water, moving in a conſtant, equal, ſlow Stream from the *Encephalon* and *Medulla ſpinalis* in each of the proper nervous Fibres, except when the Motion is changed by ſome acceſſory Cauſe, ſuch as the Mind, Preſſure of other Parts, *&c.* and let us examine how well ſuch a Suppoſition will agree with the Phænomena of the three great Functions, Nutrition, Senſation and muſcular Motion, which the Nerves are principal Inſtruments of.

In general we may well enough ſay, that Nerves can carry Fluids to the moſt minute Part of the Body, to ſupply what is waſted in any of the ſolids; that the Impreſſion made by the Objects of the Senſes on the very ſoft pulpy Extremities of the Nerves of the Organs of the Senſes, muſt make ſuch a Stop in the equal-flowing nervous Fluid, as muſt inſtantaneouſly be perceptible at the Fountain-head from which the preſſed Pipes come; That the conſtant Flow of the Liquor of the Nerves into the Cavities of the *muſcular Fibrillæ*, occaſions the natural Contraction of Muſcles, by the conſtant *niſus* it makes to increaſe the tranſverſe Diameter, and to ſhorten the longitudinal Diameter of each Fibre, and that it is only to allow the Mind a Power of pouring a greater Quantity of this ſame Fluid with a greater Velocity, into what muſcular Fibres it pleaſes, to account for the voluntary ſtrong Action of Muſcles.

61. But ſince ſuch a ſuperficial Account would not be ſatisfactory, it will be expected, that the principal Phænomena of theſe three Functions are to be explained by the Means of ſuch a Fluid as has been ſuppoſed, and that the ſeveral Objections againſt this Doctrine ſhould be anſwered: Let us attempt this, and where we cannot extricate ourſelves from Difficulties which may be thrown in, let us boldly acknowledge Ignorance.

62. *α.* If Water, with a very ſmall Proportion of Oils and Salts from the Earth, proves a fit Nouriſhment for Vegetables, ſuch a Liquor as the Fluid of the Nerves has been deſcribed (§ 55.) may not be unfit for repairing the Waſte in Animals.

β. The ſlow conſtant Motion of this nervous Fluid (§ 57, 58.) to the moſt minute Parts of the Body (§ 9.) is well enough calculated to ſupply the Particles that are conſtantly carried away from the Solids by the *Vis Vitæ*, Circulation of the Liquors and neceſſary Actions of Life.

γ. The greater proportional Size of the *Encephalon*, the great Fountain of this nutritious Liquor of the Nerves, in Creatures the younger they are, ſeems very well calculated for their greater proportional Growth at that time of Life.

δ. A Palſy and Atrophy of the Members generally accompanying each other, ſhew, that Nouriſhment, Senſation and Motion do depend on the ſame Cauſe.

ε. It was ſaid (§ 25.) that the Nerves were *principal* Inſtruments in Nutrition, it was not affirmed, that they were the *ſole* Inſtruments; and therefore an *Atrophy* may proceed from the Compreſſion or other Leſion of an Artery, without being an Objection to the Doctrine here laid down.

63. *a.* All Objects of our Senſes act by Impulſe, when they are applied to their proper Organs. Tangible Objects evidently preſs on the Surface of our Bodies: Odorous Particles need the Aſſiſtance of Air moved rapidly to affect our Noſe: Sapid Subſtances often are not ſufficient to give us any Idea of their Taſte by their own Weight, but need the Aſſiſtance of the Preſſure of the Tongue upon the Palate: The Rays of Light collected into a *Focus* drive light Bodies before them: Sound communicates a Vibration to all Bodies in harmonic Proportion with it. The Impulſe made thus by any of theſe Objects on the ſoft pulpy Nerves (§ 20.) which are full of Liquor, will preſs their Sides or Extremities, and their Li-

quor will be hindred to flow ſo freely as it did. The Canals being all full, (§ 57.) this Reſiſtance muſt inſtantaneouſly affect the whole Canals that are preſſed and their Origins, and have the ſame Effect, as if the Impulſe had been made upon the Origin itſelf. To illuſtrate this by a groſs Compariſon, let any one puſh Water out of a Syringe through a long flexible Pipe, fixed to the Syringe, he will be ſenſible of Reſiſtance, or a Puſh backwards inſtantaneouſly, as any other puts his Finger on the Orifice of the Pipe, or grips the Sides of it. This Impulſe made on the Nerves, and thus communicated to their Origin, will vary according to the Strength or Weakneſs, the Quickneſs or Slowneſs, the Continuance or ſpeedy Removal, the Uniformity or Irregularity, the Conſtancy or Alteration, *&c.* of the Application of the Objects to the Nerves.

b. Whenever the Impulſe proper to the Object is regularly applied with due Force to a Nerve rightly diſpoſed to be impreſſed by it, and is communicated, as juſt now explained, to the *Senſorium*, it gives a true and juſt Idea of the Object to the Mind.

c. The various Kinds of Impulſes, which the different Claſſes of Objects make, occaſion a Neceſſity of having the different Organs of the Senſes variouſly modified, ſo that the ſeveral Impulſes may be regularly applied to the Nerves in each Organ, or in other Words, we muſt have different Organs of the Senſes fitted to the different Claſſes of Objects.

d. As the Objects have one common Property of Impulſe, ſo all the Organs have moſt of the Properties of the Organ of Touching in common with the *Papillæ* of the Skin. In the Noſe and Tongue this is evident; in ſome Operations on the Eyes we can alſo perceive this, as we may likewiſe do in ſome Caſes, where Matter is collected in the internal Ear.

e. Theſe Properties common as well in the Objects as the Organs, occaſion frequently uncommon Effects in the Application of an Object to an Organ proper to another Object of Senſation; for ſometimes we have the ſame Idea, as if the Object had been applied to its own proper Organ; at other times the Object is as it were changed, and we have the Idea as if the Organ had had its own proper Object applied to it. Thus, for Example, Light is the proper Object to be applied to the Eye, to give us any Idea of Colours; yet when all Light is excluded from the Eyes, an Idea of Light and Colours may be excited in us by Coughing, Sneezing, Rubbing, or ſtriking the Eye-ball.—— A Cane vibrating by a Stroke, but not ſo as to give any Sound perceptible to the Ear, if it is applied to the Teeth, it raiſes a ſtrong Idea of Sound, as will alſo a little Inſect crawling in the *Meatus auditorius*.—— The Fingers applied to two rough Surfaces, rubbing on each other, are ſenſible of the Sound they make; Surgeons of any Practice in the Cure of fractured Bones can bear Witneſs to the Truth of this.—— The Fingers dipped in acid and ſeveral other acrid Liquors, have a Senſation very like to Taſting.—— Smelling and Taſting every Body knows are ſubſervient and aſſiſting to each other. From ſuch Examples we have further Proof of one general Cauſe of our Senſations, to wit, Impulſe from the Objects; and that any one of the Organs would be capable of producing the Effect of another, if the Impulſes of the different Objects could be ſregularly applied to each.

f. If the Impulſe of an Object is applied with due Force, but irregularly, a confuſed Idea of the Object is raiſed. Diſtant Objects are confus'd to *Myopes*, as very near ones are to *Presbytæ*.

g. If the Application of the Impulſe is regular, but the Force with which it is applied is too weak, our Perception of the Object is too faint. One may whiſper ſo low as not to be heard.

h. If the Application of Objects is too violent, and there is any Danger of the tender Organs of our Senſes being leſed or deſtroyed, the uneaſy Senſation we call *Pain* is raiſed, whatever the Organ thus leſed is. The Objects of Touch affect every Organ: Thus Preſſure, cutting, pricking, Salts, pungent Oils, great Heat, violent Cold, *&c.* occaſion Pain, whereever they are applied. Beſides this, every particular Organ can be affected with Pain, by the too violent Application of its own proper Object. Too much Light pains the Eyes; very loud Sound ſtuns the Ears; very odorous Bodies and too ſapid Objects hurt the Noſe and Tongue. A pretty ſure Proof this of the Objects of our Senſes all acting, and of the Organs all being impreſſed in nearly the ſame Way.

i. Whenever this uneaſy Senſation, *Pain*, is thus raiſed, a Sort of Neceſſity is as it were impoſed upon the Mind, to endeavour to get free of the injuring Cauſe, by either withdrawing the leſed Part of the Body from it, as one retires his Hand when his Finger is pricked or burnt; or the injuring Cauſe is endeavoured to be forced from the Body, as a *Teneſmus* puſhes acrid *Fæces* out of the *rectum*. In both theſe Operations a convulſive Contraction is immediately made in the leſed Part, or in the Neighbourhood of it; and if the Irritation is very ſtrong or permanent, the greater Part of the nervous Syſtem comes to be affected in that ſpaſmodic or convulſive Way.

This *Niſus*, of the Mind to free the Body of what is in Danger of being very hurtful, may ſerve to explain the Phænomena of a great many Diſeaſes, when we are acquainted with the Diſtribution of the particular Nerves; and from this we can underſtand the Operation of Medicines that ſtimulate, and may learn how by exciting a ſharp but momentary Pain, we may free the Body of another Pain that would be more durable; and that by having it thus in our Power to determine a flow of the Liquor of the Nerves to any particular Part, for the Benefit of that Part or the Relief of any other diſeaſed Part, we can do conſiderable Service by a right Application of the proper Medicines.

k. If a Pain-giving Cauſe is very violent or long continued, it deſtroys the Organs either irrecoverably, or puts them ſo much out of Order, that they only gradually recover. People have been made blind or deaf for all their Lives after, by the violent Effect of Light on their Eyes or Sound on their Ears, and we are frequently expoſed to as much Light and Sound as make us unfit to ſee or hear for a conſiderable Time after. I would explain this by a Ligature put round the tender Branch of an Herb; this Ligature drawn to a certain Degree may weaken the Canals ſo as to be unfit for the Circulation of the Juices a good While, till they are gradually explicated and made firm by theſe Juices. A ſtricter Ligature would diſorder the Structure of the Fibres ſo much, that the Liquors could not recover them. The Analogy is ſo plain it needs no Commentary.

64. 1. In applying the Fluid of the Nerves to the Action of Muſcles, it was ſaid that natural or involuntary Contraction of Muſcles was the *Niſus* which the nervous Fluid flowing conſtantly into the muſcular Fibres makes to diſtend theſe Fibrils, by enlarging their tranſverſe Diameters and ſhortning their Axes, and that voluntary Contraction was owing to a greater Quantity of that nervous Liquor determined towards the Muſcle to be put in Action, and poured with a greater *momentum* into the muſcular Fibrils by the Power of the Mind willing to make ſuch a Muſcle to act.

2. It has been objected to this account of muſcular Motion, that if it was true, the Volume of a Muſcle in Contraction neceſſarily would be conſiderably increaſed by ſo much Liquor poured into its Fibrils, whereas it does not appear by any Experiment, that the Volume of a Muſcle is increaſed by its being put into Action.

3. To this it has been anſwered, That the Spaces between the muſcular Fibres are ſufficient to allow the Fibrils ſwelling during the Contraction of a Muſcle to lodge in, without

any Addition to the Bulk of the Muſcle; and that it plainly appears that theſe Spaces between the Fibrils are thus occupied, by the Compreſſion which the larger Veſſels of Muſcles, which run in thoſe Spaces, ſuffer during the Action of a Muſcle; it is ſo great that the Muſcle becomes pale by contracting.

4. Another Objection to the Action of Muſcles being owing to the Influx of a Fluid into their Fibrils is, that muſcular Fibres are diſtractile, or capable of being ſtretched; and therefore when a Fluid is poured into their hollow Fibrils, they would be ſtretched longitudinally, as well as have their tranſverſe Diameters increaſed, that is, a Muſcle would become longer as well as thicker when it is put in Action, whereas it is known to every Body that a Muſcle is ſhortned when acting.

5. In Anſwer to this it has been remarked that tho' muſcular Fibrils are diſtractile, ye they will not yield to, or be ſtretched by every Force however little that might be applied to them, a Cord that can be ſtretched in Length by the Weight of a Pound or two, might no yield in the leaſt to an Ounce or two; and i muſt likewiſe be obſerved, that gradually a any Body is ſtretched, its Reſiſtance to th ſtretching force increaſes. A Rope may b ſtretched to a certain Length by a Poun Weight appended to it, which would requir two Pounds to ſtretch it very little further and therefore the general Obſervation of Animal Fibres being diſtractile, cannot be a rea ſonable Objection to the account of muſcula Motion above-mentioned, unleſs a Proof brought that the Force which the Liquid

the Nerves muſt exert upon each Fibre of a Muſcle in order to make a Muſcle act, is capable of diſtracting or ſtretching the Fibres, which has not yet been attempted to be proved.

6. If muſcular Motion depends on the Influx of the nervous Liquid, the inſtantaneous Contraction of a Muſcle, when the Mind wills to make it act, will eaſily be underſtood from the Nerves being always full of their Liquor, (§ 57.)

7. If either the Nerves of any Muſcle do not furniſh a ſufficient Quantity of their Liquor, or if the Fibres of a Muſcle become too eaſily diſtractile, ſuch a Muſcle will be unactive or paralytick.

8. If too great a Quantity of the Liquor of the Nerves is determined to a Muſcle or Muſcles, by any Cauſe which the Mind cannot command, ſuch Muſcle or Muſcles will be convulſed.

9. If the Motion of the Liquid of the Nerves is not uniform, but by Diſeaſe becomes irregular, an alternate Relaxation and Contraction of Muſcles may be the Conſequence, hence trembling Palſies, *chorea ſancti Viti*, &c.

10. Tho' the Nerves may not furniſh as much Liquor as may be ſufficient to make Muſcles contract with Strength enough to overcome the Reſiſtances to their Action, yet there may be enough of Liquor in the Nerves to allow the Impreſſions of Objects to be conveyed to the *ſenſorium*; this may be one Cauſe of a Member's being ſometimes ſenſible after it cannot be moved.

11. Unleſs the Liquor of the Nerves acquires ſome Energy in the Brain, which we

have no Reaſon to think the Circulation of the Fluids in the Veſſels can give it, or unleſs it has Properties other than what we can diſcover in it, or unleſs there is an active Agent determining its *momentum* towards ſome particular Parts, which we are not conſcious of; if ſome of theſe don't obtain the Action of the Heart continuing of equal Force to propel our Liquors, notwithſtanding all the Reſiſtances that are to it, is not to be explained.

12. All Muſcles, but eſpecially the Heart, will continue to contract in an irregular Way, after they are cut away from the Animal to whom they belonged, which may be owing to the Liquors continuing to flow in the ſmall Veſſels, and being poured irregularly into the muſcular *Fibrillæ*.

13. After the Heart or any other Muſcle cut away from an Animal has ceaſed to contract, its Contraction may again be reſtored by blowing one's warm Breath upon it, or pricking it with any ſharp Inſtrument; that Heat or Pricking ſhould by their *ſtimulus* (§63. 1.) occaſion Contraction in a living Creature may be underſtood; but how they ſhould have the ſame Effect in a Muſcle ſeparated from an Animal, I know not.

N. B. Num. 11, 12, 13 are as inexplicable upon any other Suppoſition yet made concerning muſcular Motion.

65. I know no Experiment or Obſervations by which any Thing can be proved, or from which any Thing can be reaſonably inferred concerning the Uſes of the *Ganglions* of the Nerves, and therefore pretend to give no Account of them.

Of the particular Nerves.

THERE are generally ſaid to be forty Pair of Nerves in all, of which ten come out from the *Encephalon*, and the other thirty have their Origin from the *Medulla ſpinalis*.

Of the ten Pair of Nerves that are generally ſaid to come from the *Encephalon*, the firſt is the *OLFACTORY*, which long had the Name of the *Mammillary Proceſſes* of the Brain, becauſe in the Brutes which were moſt commonly diſſected, their Form has ſome Reſemblance to a Nipple; for they are large where they begin to go out from the Brain, and taper a little as they go forwards to the cribriform Part of the *Ethmoid* Bone; and becauſe in theſe Animals they are evidently Continuations or Productions of the two anterior Ventricles of the Brain, being hollow and containing Lymph, the Antients believed that theſe Nerves ſerved to convey the ſuperfluous *Mucus* from the cold moiſt Brain, to be evacuated by the Holes of the cribriform Bone into the Noſe. But in Man theſe Nerves are ſmall, long, and without any Cavity, having their Origin from the *corpora ſtriata*, near the Part where the internal carotid Arteries are about to ſend off their Branches to the different Parts of the Brain, and in their Courſe under the anterior Lobes of the Brain, which have a Depreſſion made for lodging them, the human olfactory Nerves become larger till they come to the cribriform Bone where they ſplit into a great Number of ſmall Filaments to paſs thro' the little Holes in that Bone, and then each being joined by a Branch of the fifth Pair of Nerves is ſpread on the Membrane of the Noſe.

The tender Structure and ſudden Expanſion of theſe Nerves on ſuch a large Surface render it impoſſible to trace them far; which has made ſome Authors deny them to be Nerves: But when we break the Circumference of the *cribriform Lamella*, and then gently raiſe it, we may ſee the Diſtribution of the Nerves ſome way on the Membrane of the Noſe.

The Contrivance of defending theſe long ſoft Nerves from being too much preſſed by the anterior Lobes of the Brain under which they lye, is ſingular, becauſe they have not only the prominent orbitar Proceſſes of the frontal Bone, and the *Criſta Galli* of the *Ethmoid* Bone to ſupport the Brain on each Side, with the *Falx* by means of the Veins going into the longitudinal Sinus, and other Attachments bearing it up in the Middle, but have a Groove formed in each Lobe of the Brain itſelf for them to lodge in. Their ſplitting into ſo many ſmall Branches before they enter the Bones of the Skull is likewiſe peculiar to them; for generally the Nerves come from the Brain in diſgregated Filaments, and unite into Cords, as they are going out at the Holes of the Bones: But we ſhall find that this Contrivance is the beſt for anſwering the Purpoſe they are deſigned for, of being the Organ of ſmelling; for had they been expanded upon the Membrane of the Noſe into a medullary Web, ſuch as the optic Nerve forms, it would have been too ſenſible to bear the Impreſſions of ſuch Objects as are applied to it, and a Diſtribution in the more common way of a Cord ſending off Branches, would not have been equal enough for ſuch an Organ of Senſation.

The 2*d* Pair of Nerves are the *OPTIC*, which riſe each from the *thalami nervorum opticorum*, and then after making a large Curve outwards, run obliquely inwards and forwards till they unite at the Fore-part of the *Sella Turcica*, and then dividing again, each runs obliquely forwards and outwards to go out at its proper Hole in the ſphenoid Bone, accompanied with the proper ocular Artery, to run afterwards to the Globe of the Eye, within which each is extended into a very fine Cup-like Web that lines all the In-ſide of the Eye as far forwards as the *ciliary Circle*, and is univerſally known by the Name of *Retina.*

Tho' the Subſtance of theſe two Nerves ſeems to be blended at the Place where they are joined, yet Obſervations of People whoſe optic Nerves were not joined at all, and of others who have been blind of one Eye from a Fault in the optic Nerve, or in thoſe who have had one of their Eyes taken out, make it appear that there is no ſuch intimate Union of Subſtance, the optic Nerve of the affected Side only being waſted, while the other was large and plump; and the ſame Obſervations are contradictory to the Doctrine of a Decuſſation of all the Nerves (§ 7.); for the Diſeaſe could be traced from the affected Eye to the Origin of the Nerve on the ſame Side. In many Fiſhes indeed the Doctrine of Decuſſation is favoured, for their optic Nerves plainly ly croſs each other without any Union at the Part where they are joined in Men and moſt Quadrupeds.

Thoſe People, whoſe optic Nerves were not joined, having neither ſeen Objects double, nor turned their Eyes different Ways, is alſo a plain Proof that the Conjunction of the optic Nerves will not ſerve to account for either the uniform Motions of our Eyes, or our ſeeing Objects ſingle with two Eyes.

The *Retina* of a recent Eye, without any Preparation, appears a very fine Web, with ſome Blood-veſſels coming from its Center to be diſtributed on it; but after a good Injection of the Arteries that run in the Subſtance of this Nerve as is common to other Nerves, it is with Difficulty that we can obſerve its nervous medullary Subſtance. As theſe Veſſels are placed in the centrical Part of the optic Nerve, and there are not medullary Fibres here, where it enters the Ball of the Eye: This may be one Reaſon why we do not ſee ſuch Bodies or Parts of Bodies, whoſe Picture, formed on the Bottom of our Eye, falls on this centrical Part of the *Retina*. An Inflammation in thoſe Arteries of the *Retina*, which an *Opthalmia* is generally attended with, may very well account for that Tenderneſs in the Eyes, and Inability to bear the Light which People have in that Diſeaſe. The Over-diſtenſion of theſe Veſſels may likewiſe ſerve to account for the black Spots obſerved on bright coloured Bodies eſpecially, and that ſmoaky Fog, thro' which all Objects are ſeen by People in ſome Fevers. If thoſe Veſſels loſe their Tone and remain preternaturaly diſtended, no

Objects may affect our *Retina*, tho' the Eye externally appears ſound, or this may be one Cauſe of an *Amauroſis* or *Gutta ſerena*.

The *THIRD PAIR* riſe from the anterior Part of the *Proceſſus annularis*, and piercing the *Dura Mater* a little before and to a Side of the lateral Extremities of the poſterior clinoid Proceſs of the ſphenoid bone, run along the *Receptacula*, or *cavernous Sinuſes*, at the Side of the *Ephippium*, to get out at the *Foramina lacera*, to be diſtributed to the Globe of the Eye, to the *Muſculus rectus* of the *Palpebra*, and to the *Attollens*, *Adductor*, *Deprimens* and *obliquus minor* Muſcles of the Eye-ball. Theſe Muſcles being principal Inſtruments in the Motions of the Eye-lid and Eye-ball, the Nerve has therefore got the Name of the *Motor Oculi*. I have frequently obſerved in Convulſions the Eye-lids widely opened, the *Cornea* turned up and outwards, and the Eye-balls ſunk in the Orbit; which well deſcribed the conjunct Action of the Muſcles which this Pair of Nerves ſerves. Poſſibly the Diſtenſion of a conſiderable Branch of the Carotid, which paſſes over this Nerve near its Origin on each Side, may be the Reaſon of that Heavineſs in the Eye-lids and Eyes, after drinking hard or eating much.

The *FOURTH PAIR*, which are the ſmalleſt Nerves of any, derive their Origin from the poſterior Baſe of the *Teſtes*, and then making a long Courſe on the Side of the annular Protuberance, enter the *Dura Mater* a little farther back and outwards than the third Pair, to run alſo along the *Receptacula*, to paſs out at the *Foramina lacera*, and to be entirely ſpent on the *Muſculi trochleares*, or ſuperior oblique Muſcles of the Eyes. The rotatory Motions and the Advancement of the Eye-balls forward, by which Motions ſeveral of our Paſſions are expreſſed, principally depending on theſe Muſcles, the Nerves that ſerve them have got the Name of *PATHETICI*.

The *FIFTH PAIR* are large Nerves, riſing from the annular Proceſs, where the medullary Proceſſes of the *Cerebellum* join in the Formation of that *Tuber*, to enter the *Dura Mater* near the Point of the petrous Proceſs of the Temporal Bones, and then plunging into the *Receptacula* at the Side of the *Sella Turcica*, each becomes in appearance thicker, and goes out of the Skull in three great Branches.

The firſt Branch of the 5th is the *OPHTHALMICK*, which runs through the *Foramen lacerum* to the Orbit, having in its Paſſage thither a Connection with the 6th Pair: it is afterwards diſtributed to the Ball of the Eye with the 3d, to the Noſe, along with the Olfactory, which the Branch of the 5th that paſſes through the *Orbiter internus* Hole, joins in the Manner already mentioned in the Deſcription of the firſt Pair. This ophthalmic Branch likewiſe ſupplies the *Glandula lacrymalis*, Fat, Membranes, Muſcles and the Teguments of the Eye-lids, its longeſt fartheſt extended Branch paſſing through the *Foramen ſuperciliare* of the *Os Frontis* to be diſtributed to the Forehead.

The ſmall Fibres which this firſt Branch of the 5th and the third Pair of Nerves ſend to the Eye-ball, being ſituated on the optic Nervè, and after piercing the ſclerotick Coat running on the choroid Coat on the Outſide of the *Re-*

tina in their Courſe to the *Uvea* or *Iris*, may poſſibly be a Reaſon, why there is ſuch a Sympathy between the optic Nerve and the *Uvea*, that the *Uvea* contracts to leſſen the Pupil, and exclude too numerous Rays of Light; and this, with the Sympathy which muſt ariſe from ſome of the Nerves of the Membrane of the Noſtrils being derived from this firſt Branch of the 5th Pair of Nerves, may alſo be the Cauſe, why a ſtrong Irritation of too ſtrong Light upon the *Retina* may produce the ſame Effect, Sneezing, as when any tickling Subſtance is applied to the Membrane of the Noſe. In the Megrim all the Branches of this Nerve diſcover themſelves to be affected; for the Forehead is racked with Pain, the Eye-ball is pain'd, and feels as if it was ſqueezed, the Eye-lids ſhut convulſively, the Tears trickle down, and an uneaſy Heat is felt in the Noſe Hence we can underſtand, where external Medicines will have the beſt Effect, when applied to remove this Diſeaſe, to wit, to the Membrane of the Noſe and to the Forehead. Hence we can underſtand, why alternate Preſſure near the ſuperciliary Hole of the frontal Bone ſometimes gives immediate Relief in the Megrim.

The ſecond Branch of the 5th Pair of Nerves may be called *MAXILLARIS SUPERIOR*, from its ſerving principally the Parts of the upper Jaw. It goes out at the round Hole of the ſphenoid Bone, and ſends immediately one Branch in the Channel on the Top of the *Antrum maxillare*, the Membrane of which and the ſuperior Teeth are ſupplied by it in its Paſſage. As it is about to go out at the *Orbiter externus* Hole, it ſends a Nerve through the Subſtance of the *Os maxillare*, to come out at *Steno*'s Duct, to be diſtributed to the anterior Part of the Palate; and what remains of it eſcaping at the *Orbiter externus* Hole, divides into a great many Branches, that ſupply the Cheek, upper Lip and Noſtril. The next conſiderable Branch of the ſuperior maxillary Nerve is ſent into the Noſe by the Hole common to the Palate and ſphenoidal Bone, and the remaining Part of this Nerve runs in the *Palato-maxillaris* Canal, giving off Branches to the Temples and Pterygoid Muſcles, and comes at laſt into the Palate to be loſt. Hence the Ach in the Teeth of the upper Jaw occaſions a gnawing Pain deep ſeated in the Bones of the Face, with a Swelling in the Eye-lids, Cheek, Noſe and upper Lip; and on the other hand, an Inflammation in theſe Parts is often attended with ſharp Pain in the Teeth. Hence an Obſtruction in the Duct of the maxillary Sinus, which obliges the Liquor ſecreted there to find out a preternatural Rout for itſelf, as I have ſeen more than once, may be occaſioned by the Pain of the Teeth.

The third or *MAXILLARIS INFERIOR* Branch of the fifth Pair going out at the oval Hole of the ſphenoid Bone, ſerves the Muſcles of the lower Jaw, and the Muſcles ſituated between the *Os hyoides* and *Jaw*; all the ſalivary Glands, the *Amygdalæ* and the external Ear have Branches from it; it has a large Branch loſt in the Tongue, and ſends another through the Canal in the Subſtance of the lower Jaw, to ſerve all the Teeth there, and to come out at the Hole in the anterior Part of the Jaw, to be loſt in the Chin and Under-lip. Hence a convulſive Contraction of the Muſcles of the lower Jaw, or the Mouth's being involuntarly ſhut, a great Flow of Spittle or Salivation, a Pain in the Ear eſpecially in Deglutition, and a Swelling all about the Throat, are natural Conſequences of a violent Irritation of the Nerves of the lower Teeth in the Tooth-ach; and Pain in the Teeth and Ear is as natural a Conſequence of an *Angina*. Hence alternate Preſſure on the Chin may ſometimes relieve the Violence of a Tooth-ach. Hence deſtroying the Nerves of a Tooth by actual or potential Cauteries, or pulling a carious Tooth, ſo often removes immediately all theſe Symptoms. Hence no Cure is to be found for ſome Ulcers in the upper or lower Jaw, but by drawing a Tooth.

The *SIXTH PAIR*, which is the ſmalleſt except the fourth, riſes from the Forepart of the *Corpora pyramidalia*, and entring the *Dura Mater* ſome way behind the Extremities of the poſterior clinoid Proceſſes of the ſphenoid Bone, have a long Courſe below that Membrane, and within the *Receptacula* at the Side of the *Sella Turcica*, to go out at the *Foramina lacera* into the Orbit, to be loſt in the Abductor-muſcle of the Eye. In this Paſſage each of them lies very contiguous to the internal carotid Artery, and to the ophthalmick Branch of the fifth Pair of Nerves. At the ſame Place where they are contiguous to the Carotid, a Nerve, either, according to the general Deſcription of Anatomiſts, goes from each of them in an uncommon way (that is the Angle is obtuſe beyond where it riſes) to deſcend with the Artery, and to form the Beginning of the *intercoſtal* Nerve; or, according to other Authors, this Nerve comes up from the great *Ganglion* of the *Intercoſtal* to be joined to the ſixth here.

The Arguments for this latter Opinion are, That according to the common Opinion, this Beginning of the *intercoſtal* Nerve, as 'tis called, would riſe in a Manner not ſo ordinary in Nerves. In the next Place it is obſerved, that the ſixth Pair is larger nearer to the Orbit, than it is before it comes to the Place where this Nerve is ſaid to go off; and therefore it is more probable, that it receives an Addition there rather than gives off a Branch. *Laſtly*, It is found, that upon cutting the *intercoſtal* Nerves of living Animals, the Eyes plainly were affected, they loſt their bright Water, the Gum, or Gore, as we call it, was ſeparated in greater Quantity, the Pupil was more contracted, the cartilaginous Membrane at the internal Canthus came more over the Eye, and the Eye-ball itſelf was diminiſhed.

To this it is anſwered in Defence of the more common Doctrine, that other Branches of Nerves go off in a reflected Way as well as this does, ſuppoſing it to be the Beginning of the Intercoſtal, and that the Reflection would rather be greater, if it is thought to come up from the Intercoſtal to the ſixth. 2*dly*, That Nerves enlarge ſometimes where there is no Addition made to them, as in the Inſtance already mentioned of the Trunk of the fifth Pair while below the *Dura Mater*. 3*dly*, That the Experiments on living Animals ſhew indeed, that the Eyes are affected upon cutting the intercoſtal Nerve, but not in the Way might have been expected, if the *Intercoſtal* furniſhes ſuch a Share of the Nerve that goes to the *Abductor* Muſcle of the Eye; for it might have been thought, that this Muſcle would have been ſo much weakned immediately upon cutting the *Intercoſtal*, as its Antagoniſt the *Adductor* would have greatly prevailed over it, and have turned the Eye ſtrongly in towards the Noſe, which is not ſaid to be a Conſequence of this Experiment. So that the Arguments are ſtill equivocal, and more Obſervations and Experiments muſt be made before it can be determined with Certainty, whether the ſixth Pair gives or receives a Branch here. In the mean time I ſhall continue to ſpeak about the Origin of the *Intercoſtal* with the common Herd of Anatomiſts.

At this ſame Place where the Intercoſtal begins, the fifth Pair is contiguous and adherent to the ſixth; and it is generally ſaid, that the ophthalmic Branch of the fifth gives a Branch or two to the Beginning of the Intercoſtal, or receives ſuch from it. Others deny any ſuch Communication between them, and thoſe who affirm the Communication confeſs, that in ſome Subjects they could not ſee it. After examining the Nerves here in a great many Subjects, I cannot determine whether or not there are nervous Filaments going from the one to the other. Sometimes I thought I traced them evidently; at other times I obſerved what I diſſected for nervous Filaments, to be no other than collapſed cellular Subſtance; and in all the Subjects where I had puſhed an Injection ſucceſsfully into the very ſmall Arteries, I could only obſerve a *Plexus* of Veſſels connecting the one to the other. In any of theſe Ways however there is as much Connection, as we are aſſured from many Experiments and Obſervations on other Nerves, is ſufficient to make a very great Sympathy among the Nerves here. Poſſibly the Appearances in the Eyes of Dogs, whoſe intercoſtal Nerves were cut, might be owing to this Sympathy.

The *SEVENTH PAIR* comes out from the lateral Part of the *annular Proceſs*, behind where the medullary Proceſſes of the *Cerebellum* are joined to that *Tuber*, and, being accompanied with a larger Artery than moſt other Nerves, enters the *internal Meatus auditorius*, where ſoon the two great Pacquets of Fibres, of which it appeared to conſiſt within the Skull, ſeparate from each other; one of them enters by ſeveral ſmall Holes into the *Veſtible*, *Cochlea* and *ſemicircular Canals*, is ſtretched on this inner *Camera* of the Ear in a very ſoft pulpy Subſtance; and being never ſeen in the Form of a firm Cord, ſuch as the other Packet of this Nerve and moſt other Nerves become, is called *PORTIO MOLLIS* of the auditory Nerve.

The other Part of this ſeventh Pair paſſes through *Galen's Foramen cæcum* or *Fallopius's Aqueduct* in its crooked Paſſage by the Side of the *Tympanum*, in which Paſſage a Nerve ſent from the lingual Branch of the inferior maxillary Nerve, along the outſide of the *Tuba Euſtachiana*, and croſs the Cavity of the *Tympanum*, where it has the Name of *Chorda Tympani*, is commonly ſaid to be joined to it. The very acute Angle which this Nerve makes with the fifth, or the ſudden violent Reflexion it would ſuffer, on the Suppoſition of its coming from the fifth to the ſeventh, whereas ſuppoſing its Courſe from the ſeventh to the fifth, its Courſe would be more in the ordinary Way, has made ſome ſay, that this *Chorda tympani* ſhould be eſteemed a Branch of the ſeventh Pair going to join the fifth. This ſame ſmaller Packet of the ſeventh gives Branches to the Muſcles of the *Malleus* and to the *Dura Mater*, while it paſſes through the bony crooked Canal, and at laſt comes out in a firm Cord named *PORTIO DURA*, at the Extremity of this Canal, between the *ſtyloid* and *maſtoid* Proceſſes of the temporal Bone, giving immediately Filaments to the little oblique Muſcles of the Head, and to thoſe that riſe from the ſtyloid Proceſs. It then pierces through the parotid Gland, and divides into a great many Branches, which are diſperſed in the Muſcles and Teguments that cover all the Side of the ſuperior Part of the Neck, the whole Face and *Cranium*, as far back as the Temples, including a conſiderable Part of the external Ear. Its Branches having thus a conſiderable Connection with all the three Branches of the fifth Pair, and with the ſecond cervical, occaſions a conſiderable Sympathy of theſe Nerves with it. Hence in the Tooth-ach, the Pain is ſometimes very little in the affected Tooth, compared to what it is all along the Side of the Head and in the Ear. Hence probably the Relief of the Tooth-ach by Bliſters applied behind the Ear, or by a hot Iron touching the *Antihelix* of the Ear. By this Communication or Connexion poſſibly too it is, that a vibrating String held between one's Teeth, gives him a ſtrong Idea of its Sound which no other can hear. Perhaps too the Diſtribution of this Nerve occaſions the Head to be ſo quickly turned upon the Impreſſion of Sound on our Ears.

The *EIGHTH PAIR* of Nerves riſe from the lateral Baſe of the *Corpora olivaria* in diſgregated Fibres, and as they are entring the anterior internal Part of the Hole, common to the *Os Occipitis* and *Temporum*, each is joined by a Nerve which aſcends within the *Dura Mater* from the 10th of the Head, the firſt and ſecond cervical, and ſometimes from inferior Nerves: This every Body knows has the Name of the *NERVUS ACCESSORIUS*. When the two get out of the Skull, the *Acceſſorius* ſeparates from the eighth, and deſcending obliquely outwards, paſſes through the *Sternomaſtoideus* Muſcle, to which it gives Branches to be loſt in the *Trapezius* and *Rhomboid* Muſcles of the *Scapula*. In this Courſe it is generally more or leſs joined by the ſecond cervical Nerve.

The large *eighth Pair* ſoon after its Exit gives Nerves to the Tongue, *Larynx*, *Pharynx* and *Ganglion* of the *Intercoſtal* Nerve, and being disjoined from the 9th and Intercoſtal, to which it adheres cloſely ſome way, runs ſtraight down the Neck behind the internal jugular Vein, and at the interior Side of the internal carotid Artery. As it is about to enter the *Thorax*, a large Nerve goes off from the eighth of each Side: This Branch of the right Side turns round from the anterior to the poſterior Part of the ſubclavian Artery, while the Branch of the left Side turns round the great

Curve of the *Aorta*, both of them mounting up again at the Side of the *OEſophagus*, to which they give Branches, are loſt at laſt in the *Larynx*. Theſe are called the *RECURRENT* Nerves, which we are deſired to ſhun in the Operation of *Bronchotomy*, tho' their deep Situation protects them ſufficiently. The Muſcles of the *Larynx* being in a good meaſure ſupplied with Nerves from the Recurrents, it is to be expected, that the cutting of them will greatly weaken the Voice, tho' it will not be entirely loſt, ſo long as the ſuperior Branches of the eighth Pair are entire.

At or near the Place where the recurrent Nerves go off from the eighth Pair, or frequently from the Recurrents themſelves, Nerves go off to the *Pericardium*, and to join with the Branches of the Intercoſtal that are diſtributed to the Heart.

After theſe Branches are ſent off, the *Par vagum* on each Side deſcends behind the great Branch of the *Trachea* and gives numerous Filaments to the Lungs in going to the *OEſophagus*. The one of the left Side running on the Forepart of the *OEſophagus*, communicates by ſeveral Branches with the right one in its Deſcent to be diſtributed to the Stomach: The right one gets behind the *OEſophagus*, where it ſplits and rejoins ſeveral Times before it arrives at the Stomach, to which it ſends Nerves; and then being joined by a Branch from the left Trunk, they run towards the cæliac Artery, there to join into the great *ſemilunar Ganglion* formed by the two Intercoſtals.

From the Diſtribution of this *Par vagum*, we may learn how tickling the *Fauces* with a

Feather or any ſuch Subſtance, excites a Nauſea and Inclination to vomit. Why coughing occaſions vomiting, or vomiting raiſes a Cough. Hence we ſee how the nervous *Aſthma* and the *Tuſſis convulſiva*, Kinkcough, are attended with a ſtraitning of the *Glottis*. How Food ill to digeſt brings on the *Aſthma* on weakly People, and why *Emetics* have frequently cured the *Aſthma* very ſpeedily. How the ſuperior Orifice of the Stomach is ſo ſenſible as to be looked on as the Seat of the Soul by ſome. How People ſubject to Diſtenſions of the Stomach have ſo often the Senſations of Balls in their Breaſt or Throats. Why the *Globus hyſtericus* is ſo often attended with a violent Strangulation at the *Glottis*. The Sympathy among the Branches of theſe Nerves will lead us to underſtand theſe and ſeveral other Phænomena.

The *NINTH PAIR* of Nerves comes from the inferior Part of the *Corpora pyramidalia*, to go out of the Skull at their proper Holes of the occipital Bones. After their Egreſs they adhere for ſome way firmly to the 8th and Intercoſtal, and then ſending a Branch that in many Subjects is joined with Branches of the firſt and ſecond cervical Nerves, to be diſtributed to the Thyroid Gland and Muſcles on the Fore-part of the *Trachea Arteria*, the 9th is loſt in the Muſcles and Subſtance of the Tongue. Some have thought this Nerve, and others have eſteemed the third Branch of the fifth Pair of Nerves to be the proper guſtatory Nerve. I know no Obſervations or Experiments to prove either Opinion, or to determine that both the Nerves may not ſerve for

Taſting, and for the Motion of the Tongue.

The *TENTH PAIR* riſes from the Sides of the *Medulla ſpinalis*, to go out between the *Os Occipitis* and *firſt Vertebra* of the Neck. After each of them gives a Branch to the great Ganglion of the Intercoſtal Nerve, they are diſtributed to the oblique Muſcles, and to ſome of the Extenſors of the Head. Whether the Name of the tenth of the Head, or of the firſt Vertebral, ought to be given to this Nerve, is of no ſuch Conſequence as to deſerve a Debate.

In the Deſcription of the ſixth Pair, I ſaid that I would uſe the way of ſpeaking which moſt Anatomiſts have, to wit, I would ſay that the Beginning of the Intercoſtal Nerve comes out of the Skull, and therefore ſhall here ſubjoin a curſory Deſcription of this Nerve to thoſe of the Head, notwithſtanding its much larger Part is compoſed of Nerves coming out from the *Medulla ſpinalis*. There is no greater Incongruity in Point of Method to ſay, that a Nerve one is deſcribing receives Additions from Nerves that have not been deſcribed, than it is to repeat in the Deſcription of a great many Nerves, that each of them gives Branches to form a Nerve which we are ignorant of, which is all the Difference between deſcribing the Intercoſtal before or after the ſpinal Nerves.

The Branch reflected from the ſixth Pair, joined poſſibly by ſome Filaments of the *Ophthalmic* Branch of the fifth, runs along with the internal Carotid thro' the crooked Canal formed for this Artery in the *temporal Bone*, where the little Nerve is very ſoft and pappy, and in ſeveral Subjects divides and unites again before it comes out of the Skull. As ſoon as the Nerve eſcapes out of this bony Canal it is connected a little way with the eighth and ninth, then ſeparating from them, after ſeeming to receive additional Nerves from them, it forms a *large Ganglion*, into which Branches from the tenth of the Head, and from the firſt and ſecond cervical enter. From this Ganglion the Nerves come out again ſmall to run down the Neck along with the carotid Artery, communicating by Branches with the cervical Nerves, and giving Nerves to the Muſcles that bend the Head and Neck. As the *Intercoſtal* is about to enter the *Thorax*, it forms another Ganglion from which Nerves are ſent to the Trachea and to the Heart; theſe deſigned for the Heart joining with the Branches of the eighth, and paſſing between the two great Arteries and the Auricles to the Subſtance of that Muſcle. The Intercoſtal after this being compoſed of two Branches, one going behind, and the other running over the anterior Part of the Subclavian Artery, forms a new Ganglion where the two Branches unite below that Artery, and then deſcending along the Sides of the *Vertebræ* of the *Thorax*, receives Branches from each of the dorſal Nerves, which Branches appearing to come out between the Ribs, have given the Name of Intercoſtal to the whole Nerve. Where the Addition is made to it from the fifth dorſal Nerve, a Branch goes off obliquely forwards, which being joined by other ſuch Branches from the ſixth, ſeventh, eighth and ninth dorſal, an anterior Trunk is formed that paſſes between the Fibres of the *Appendix muſculoſa* of the Diaphragm to form along with the other Intercoſtal and the Branches of the eighth Pair, a large ſemilunar Ganglion ſituated between the cæliac and ſuperior meſenteric Arteries; the Roots of which are, as it were, involved in a ſort of nervous Network of this Ganglion, from which a great Number of very ſmall nervous Threads run out to be extended on the Surface of all the Branches of theſe two Arteries, ſo as to be eaſily ſeen when any of the Arteries are ſtretched, but not to be diſſected off from them; and thus the *Liver*, *Gall-Bladder*, *Duodenum*, *Pancreas*, *Spleen*, *Jejunum*, *Ilium*, and a large Share of the *Colon* have their Nerves ſent from this great *ſolar Ganglion* or *Plexus*.

Several Fibres of this Ganglion running down upon the Aorta, meet with other Nerves ſent from the poſterior Trunk of the Intercoſtal, which continues its Courſe along the Sides of the *Vertebræ*, they ſupply the *Glandulæ renales*, Kidneys and *Teſtes* in Men or *Ovaria* in Women; and then they form a Net-work upon the inferior meſenteric Artery where the Nerves of the two Sides meet, and accompany the Branches of this Artery to the Part of the *Colon* that lies in the left Side of the Belly, and to the *Rectum* as far down as the lower Part of the *Pelvis*.

The Intercoſtal continuing down by the Side of the *Vertebræ* of the Loins, is joined by Nerves coming from between theſe *Vertebræ*, and ſends Nerves to the Organs of Generation and others in the *Pelvis*, being even joined with thoſe that are ſent to the inferior Extremities.

The almoſt univerſal Connection and Communication this Nerve has with the other Nerves of the Body, may lead us to underſtand a great many *Phænomena*, where one otherwiſe would be greatly ſurprized at the Sympathy to be obſerved among the Parts of the Body. One who knows the Courſe of this Nerve will readily underſtand why a Stone in the Kidneys, or Ureters, or any other Cauſe irritating thoſe Organs, ſhould ſo much more frequently bring on Vomiting and other Diſorders of the Stomach, than the Stone or any other ſtimulating Cauſe in the Bladder does. The Obſtructions of the *Menſes* will hence appear capable of occaſioning Strangulations, Belching, Colicks, Stomach-aches, and even Convulſions in the Extremities may be owing to ſuch Obſtructions, or to any violent Irritations of the Stomach or Guts. With a View to theſe Communications, I have frequently applied Veſicatories from the Ears to the Clavicles of Children labouring under the *Tuſſis convulſiva* with obſervable good Succeſs.

The *ſpinal* Nerves riſe generally by a Number of diſgregated Fibres from both the anterior and poſterior Part of the *Medulla ſpinalis*, and ſoon after form a little Knot or Ganglion where they get on their firm Coats, and are extended into firm Cords. They are diſtinguiſhed by Numbers, according to the *Vertebræ* from between which they come out, the ſuperior of the two Bones forming the Hole thro' which they paſs, being the one from which the Number is applied to each Nerve.

There are generally ſaid to be *thirty Pair* of them, ſeven of which come out between the *Vertebræ* of the *Neck*, twelve between thoſe of the *Back*, five from the *Loins*, and ſix from the *Os ſacrum.*

The *FIRST CERVICAL* Pair of Nerves comes out between the firſt and ſecond *Vertebræ* of the Neck, and having given Branches to join with the tenth Pair of the Head, the ſecond Cervical and Intercoſtal, and to ſerve the Muſcles that bend the Neck, it ſends its largeſt Branches backwards to the extenſor Muſcles of the Head and Neck; ſome of which piercing thro' theſe Muſcles run up on the *Occiput* to be loſt in the Teguments there; and many Fibres of it advance ſo far forward, as to be connected with the *Fibrillæ* of the firſt Branch of the fifth Pair of the Head, and of the *Portio Dura* of the *Auditory Nerve.* Hence poſſibly it is that a *Clavus hyſtericus* ſhall ſuddenly change from the Fore-head to a violent Pain and Spaſm in the Back-part of the Head and Neck.

The *SECOND CERVICAL* is ſoon joined by ſome Branches to the ninth of the Head and Intercoſtal, and to the firſt and third of the Neck, then has a large Branch that comes out at the exterior Edge of the *Sternomaſtoideus* Muſcle, where it joins with the *Acceſſorius* of the eighth Pair, and then is diſtributed to the *Platyſma Myoides*, Teguments of the Side of the Neck and Head, parotid Gland and external Ear, being connected to the *Portio Dura* of the Auditory Nerve and to the firſt cervical. The Remainder of this ſecond Cervical is ſpent on the *Levator ſcapulæ*, and the Extenſors of the Neck and Head. Generally a large Branch is here ſent off to join the *Acceſſorius* of the eighth Pair, near the ſuperior Angle of the *Scapula.*

To the Irritation of the Branches of this Nerve, it probably is, that in an Inflammation of the parotid Gland, the Neck is pain'd as far down as the Clavicle, the Head is drawn towards the Shoulder of the affected Side, and the Chin is turned to the other Side. In opening the external Jugular-Vein, no Operator can promiſe not to touch ſome of the cutaneous Branches of this Nerve with the Edge of the Lancet, which occaſions a ſharp pricking Pain in the mean Time, and a Numneſs of the Skin near the Orifice for ſome Time after.

The *THIRD PAIR* of the Neck paſſes out between the third and fourth cervical *Vertebræ*, having immediately a Communication with the ſecond, and ſending down a Branch, which being joined by a Branch from the fourth cervical forms the *PHRENIC* Nerve. This deſceding enters the *Thorax* between the ſubclavian Vein and Artery, and then being received into a Groove formed for it in the *Pericardium*, it has its Courſe along this *Capſula* of the Heart, till it is loſt in the middle Part of the Diaphragm. The right Phrenic has a pretty ſtreight Courſe, but the left one is obliged to make a conſiderable Turn outwards, to go over the prominent Part of the *Pericardium* where the Point of the Heart is lodged. Hence in violent Palpitations of the Heart, a pungent acute Pain is felt near the left Orifice of the Stomach.

The other Branches of the third cervical

Nerve are diſtributed to the Muſcles and Teguments at the inferior Part of the Neck and Top of the Shoulder. No Wonder then that an Inflammation of the Liver or Spleen, an Abſceſs in the Lungs adhering to the Diaphragm, or any other Cauſe capable of irritating the Diaphragm, ſhould be attended with a ſharp Pain in the Top of the Shoulder, as well as Wounds, Ulcers, *&c.* of this Muſcle itſelf. If the Irritation of this Muſcle is very violent, it may occaſion that convulſive Contraction of the Diaphragm which is called a Hiccough, and therefore a Hiccough in an Inflammation of the Liver has been juſtly declared to be an ill Symptom.

The Irritation of the thoracic Nerves ſo as to produce ſneezing, may ſometimes free the phrenic Nerves from any Spaſm they occaſion; ſo that ſneezing ſometimes takes away the Hiccough, and a Derivation of the Fluid of the Nerves any other way may do the ſame Thing: Or the Hiccough may alſo be ſometimes cured by a Surprize, or any other ſtrong Application of the Mind in thinking or in diſtinguiſhing Objects.

The *FOURTH CERVICAL* Nerve, after ſending off that Branch which joins with the third to form the Phrenic, and beſtowing Twigs on the Muſcles and Glands of the Neck runs to the Arm-Pit, where it meets with the *FIFTH*, *SIXTH* and *SEVENTH* Cervicals and *FIRST DORSAL*, that eſcape in the Interſtices of the *Muſculi ſcaleni*, to come at the Arm-Pit where they join, ſeparate, and re-join in a way ſcarce to be rightly expreſſed in Words; and after giving ſeveral conſiderable Nerves to the Muſcles and Teguments which cover the *Thorax*, they divide into ſeveral Branches to be diſtributed to all the Parts of the ſuperior Extremity. Seven of theſe Branches I ſhall deſcribe under particular Names.

1. *CUTANEUS* runs down the Fore-part of the Arm near the Skin to which it gives off Branches, and then divides on the Fore-arm into ſeveral Nerves, which ſupply the Teguments there and on the Palm of the Hand. In opening the Cephalic Vein of the Arm at the ordinary Place, the ſame Symptoms are produced, as I mentioned to be done in opening the external Jugular-Vein, and by the like Cauſe, to wit, the hurting a Branch of this cutaneous Nerve with the Lancet.

2. *MUSCULO-CUTANEUS* or *perforans Caſſerii* paſſes thro' the *coraco-brachialis* Muſcle, and, after ſupplying the *biceps flexor cubiti* and *brachiæus internus*, is ſpent on the Teguments on the out-ſide of the Fore-arm and Back of the Hand.

3. *MUSCULARIS* has a ſpiral Courſe from the *Axilla* under the *Os humeri*, and backward to the external Part of that Bone, ſupplying by the Way the extenſor Muſcles of the Fore-arm, to which it runs between the two *brachiæi* Muſcles, to be chiefly beſtowed on the Muſcles that extend the Wriſt and Fingers; ſome of its Branches going likewiſe to the Flexors, and others ſerving the Skin on the out-ſide of the Fore-arm, the Extremity of it deſcends along the *Radius* to the Back of the Hand, in which, and in the back convex Part

of the Thumb and three large Fingers it terminates.

4. *ULNARIS* is extended along the In-ſide of the Arm, to give Nerves to the Muſcles that extend the Fore-arm and to the Teguments of the Elbow; towards the lower Part of the Arm it ſlants a little backward to come at the Groove behind the internal Condyle of the *Os humeri*, thro' which it runs to the *Ulna*; in its Courſe along this Bone it ſerves the neighbouring Muſcles and Teguments; and as it comes near the Wriſt, it detaches a Branch obliquely over the *Ulna* to the Back of the Hand, to be loſt in the convex Part of ſeveral Fingers. The larger Part of the Nerve goes ſtraight forward to the internal Side of the *Os piſiforme* of the Wriſt; where it ſends off a Branch which ſinks under the large Tendons in the Palm, to go croſs to the other Side of the Wriſt, ſerving the *muſculi lumbricales* and *interoſſei*, and at laſt terminating in the ſhort Muſcles of the Thumb and Fore-finger. What remains of the ulnar Nerve, after ſupplying the ſhort Muſcles of the Little-finger, divides into three Branches; whereof two are extended along the Sides of the Sheath of the Tendons of the Flexors of the Little-finger, to furniſh the concave Side of that Finger; and the third Branch is diſpoſed in the ſame Way upon the Side of the Ring-finger next to the Little finger.

When we lean or preſs on the internal Condyle of the *Os humeri*, the Numneſs and Prickling we frequently feel point out the Courſe of this Nerve; I have ſeen a Weakneſs and Atrophy in the Parts which I mentioned this Nerve to be ſent to, after a Wound in the internal inferior Part of the Arm.

5. *RADIALIS* accompanies the humeral Artery to the bending of the Elbow, ſerving the Flexors of the Cubit in its Way; then, after giving large Nerves to the Muſcles on the Fore-part of the Fore-arm, it continues its Courſe near to the *Radius*, beſtowing Branches on the circumjacent Muſcles. Near the Wriſt it gives off a Nerve which is diſtributed to the Back of the Hand, and the convex Part of the Thumb, and ſeveral of the Fingers. The larger Part of this Nerve paſſing behind the annular Ligament of the Wriſt gives Nerves to the ſhort Muſcles of the Thumb, and afterwards ſends a Branch along each Side of the Sheath of the Tendons of the Flexors of the Thumb, Fore-finger, Middle-finger, and one Branch to the Side of the Ring-finger next to the Middle, to be loſt on the concave Side of thoſe Fingers.

The Manner of theſe Nerves of the Fingers, both from the *Ulnar* and *Radial* going off, is that a ſingle Branch is ſent from the Trunk to the Side of the Thumb and Little-finger fartheſt from the other Fingers; and all the reſt are ſupplied by a Trunk of a Nerve, which ſplits into two ſome way before it comes as far as the End of the *Metacarpus*, to run along the Sides of different Fingers that are neareſt to each other.

It might have been obſerved, that in deſcribing the poſterior Branches of the *ulnar* and *radial Nerve*, I did not mention the particular Fingers, to the convex Part of which, they were diſtributed. My Reaſon for this Omiſſion is the Uncertainty of their Diſtribution; for tho' ſometimes theſe poſterior Branches go to the ſame Fingers, to the concave Part of which their anterior Branches are ſent, yet frequently they are diſtributed otherwiſe, and I ought to obſerve that the muſcular Nerve has not always that Termination in the Back of the Hand which I mentioned.

6. *ARTICULARIS* ſinks downwards at the *Axilla*, to get below the Neck of the ſuperior Head of the *Os humeri*, and to mount again at the Back-part of it; ſo that it almoſt ſurrounds the Articulation, and is diſtributed to the Muſcles that draw the Arm back and raiſe it up.

7. *SCAPULARIS* runs ſtraight to the *Cavitas ſemilunata* of the upper *Coſta* of the *Scapula*, which is made a Hole in the recent Subject, a Ligament being extended from one Angle of the Bone to the other, giving Nerves in its Way to the Muſcles of the *Scapula*. When it has paſſed this Hole it ſupplies the *Supraſpinatus* Muſcle, and then deſcending at the anterior Root of the *Spine* of the *Scapula*, it is loſt in the other Muſcles that lye on the *Dorſum* of the *Scapula*.

The Situation of theſe brachial Nerves in the *Axilla*, may let us ſee how a Weakneſs and Atrophy may be brought on the Arms by long continued Preſſure of Crutches, or ſuch other hard Subſtances on this Part; and the Courſe of them from the Neck to the Arm may teach us how much better Effects, Veſicatories or ſtimulating nervous Medicines would have, when applied to the Skin, covering the tranſverſe Proceſſes of the *Vertebræ*, or at the *Axilla*, than when they are put between the Shoulders, or upon the ſpinal Proceſſes in Convulſions or Palſies of the ſuperior Extremities, where a Stimulus is required.

The *TWELVE DORSAL* Nerves of each Side as ſoon as they eſcape from between the *Vertebræ*, ſend a Branch forward to join the Intercoſtal, by which a Communication is made among them all, and they ſoon likewiſe give Branches backwards to the Muſcles that raiſe the Trunk of the Body, their principal Trunk being extended outwards to come at the Furrow in the lower Edge of each Rib, in which they run toward the anterior Part of the *Thorax*, between the internal and external intercoſtal Muſcles, giving off Branches in their Courſe to the Muſcles and Teguments of the *Thorax*.

The *FIRST* Dorſal has already been ſaid to have this Particular in it, that it contributes to form the brachial Nerves, and that the two Branches of the Intercoſtal, which come down to the *Thorax*, form a conſiderable Ganglion with it.

The *SIX* inferior dorſal Nerves give Branches to the Diaphragm and abdominal Muſcles.

The *TWELFTH* joins with the firſt Lumbar, and beſtows Nerves on the *Muſculus quadratus Lumborum* and *Iliacus internus*.

May not the Communications of all theſe Nerves be one Reaſon of the Parts they ſerve acting ſo uniformly and conjunctly in Reſpiration, and conſpiring together in the convulſive Motions of Coughing, Sneezing, *&c*?

The twitching Spaſms that happen ſometimes in different Parts of the Muſcles of the *Abdomen*, by any Irritation on the Branches of the lower dorſal Nerves are in Danger of occaſioning a Miſtake in Practice, by their Reſemblance to the Colick, *Nephritis*, *&c.* The Communications of theſe lower ones with the Intercoſtals may ſerve to explain the violent Effort of the abdominal Muſcles in a *Teneſmus* and in Child-bearing.

As the Intercoſtal is ſo much larger in the *Thorax* than any where elſe, and ſeems to diminiſh gradually as it aſcends and deſcends, there is ſome Suſpicion that the Trunk of it is here, from which the ſuperior and inferior Parts are ſent as Branches.

The *FIVE LUMBAR* Nerves on each Side communicate with the Intercoſtal and with each other, and give poſterior Branches to the Loins.

The *FIRST* commuicates with the laſt dorſal, ſends Branches to the abdominal Muſcles, to the *Pſoas* and *Iliacus*, and to the Teguments and Muſcles on the anterior Part of the Thigh; while its principal Branch joins with other Nerves to form the crural Nerve.

The *SECOND LUMBAR* Nerve paſſes through the *Pſoas Muſcle*, and is diſtributed nearly in the ſame Way as the former, as is alſo the *THIRD*.

Branches of the *firſt*, *ſecond* and *third* make up one Trunk, which runs along the anterior Part of the *Pelvis*, and paſſing in the Notch at the anterior Part of the great Hole common to the *Os Pubis* and *Iſchium*, is ſpent on the *Adductor* Muſcles and the Teguments on the Inſide

ſide of the Thigh. This Nerve is called the *OBTURATOR* or *POSTERIOR CRURAL NERVE.*

By united Branches from the *firſt*, *ſecond*, *third* and *fourth* lumbar Nerves, a Nerve is formed that runs along the *Pſoas* Muſcle, to eſcape with the external Iliac Veſſels out of the *Abdomen*, below the tendinous Arcade of the external oblique Muſcle. This Nerve, which is named the *ANTERIOR CRURAL*, is diſtributed principally to the Muſcles and Teguments on the anterior Part of the Thigh. A Branch however of this Nerve runs down the Inſide of the Leg to the ſuperior Part of the Foot keeping near to the *Vena ſaphæna*; in opening of which with a Lancet at the Ancle, the Nerve is ſometimes hurt, and occaſions ſharp Pain at the Time of the Operation, and Numneſs afterwards.

The Remainder of the fourth Lumbar and the fifth joins in compoſing the largeſt Nerve of the Body, which is ſoon to be deſcribed.

Whoever attends to the Courſe of theſe lumbar Nerves, and of the ſpermatic Veſſels and Nerves upon the *Pſoas* Muſcle with the oblique Paſſage of the *Ureter* over that Muſcle, will not be ſurprized, that when a Stone is paſſing in this Canal, or even when it is inflamed, the Trunk of the Body cannot be raiſed erect without great Pain; or that the Skin of the Thigh becomes more inſenſible, and the Thigh is drawn forward, and that the Teſticle often is drawn convulſively towards the Ring of the abdominal Muſcles.

The *SIX PAIR* of the *OS SACRUM* conſiſt each of ſmall poſterior Branches ſent to the Hips, and of large anterior Branches.

The *firſt*, *ſecond* and *third*, after coming through the three ſuperior Holes of the *Os ſacrum*, join together and with the fourth and fifth of the Loins, to form the largeſt Nerve by much of the Body, which is well known by the Name of *SCIATIC* or *ISCHIATIC* Nerve: This, after ſending large Nerves to the different Parts of the *Pelvis*, and to the external Parts of Generation and the *Podex*, as alſo to the Muſcles of the Hips, paſſes behind the great *Tuber* of the *Os Iſchium*, and then over the *Quadrigemini* Muſcles to run down near to the Bone of the Thigh at its poſterior Part, giving off Nerves to the neighbouring Muſcles and Teguments. Some Way above the Ham, where it has the Name of the *Poplitæus* Nerve, it ſends off a large Branch that paſſes over the *Fibula*, and ſinking in among the Muſcles on the anterior external Part of the Leg, runs down to the Foot, to be loſt in the ſuperior Part of the larger Toes, ſupplying the neighbouring Muſcles and Teguments every where in its Paſſage. The larger Branch of the *Sciatic*, after giving Branches to the Muſcles and Teguments about the Ham and Knee, and ſending a large cutaneous Nerve down the Calf of the Leg, to be loſt at laſt in the exterior Side of the Foot and ſuperior Part of the leſſer Toes, ſinks below the *Gemellus* Muſcle, and diſtributes Nerves to the Muſcles on the Back of the Leg; among which it continues its Courſe, till paſſing behind the internal *Malleolus* and in the internal Hollow of the *Os Calcis*, it divides into the two plantar Nerves. The internal of which is diſtributed to the

Toes, in the ſame Manner as the radial Nerve of the Hand ſerves the concave Side of the Thumb and Fingers, and the external Plantar is divided and diſtributed to the Sole of the Foot and Toes, nearly as the ulnar Nerve is in the Palm of the Hand and in the concave Part of the Fingers.

By applying what was ſaid of the Nerves in general to the particular Diſtribution of the Nerves of the inferior Extremities, we may ſee how People with fractured Legs, eſpecially where there are Splinters, ſhould be ſo ſubject to convulſive Startings of the fractured Member, and why upon tying the Blood-veſſels in an Amputation of the Leg, the Patients ſhould ſometimes complain of violent Pain in their Toes; why ſuch Patients ſhould alſo be troubled with Startings, or why, for a conſiderable Time after the Amputation of the diſeaſed Limb, when the Suppuration is well advanced, they ſhould complain of Pain in the Sore which occaſioned the Amputation.

The *FOURTH* Nerve of the *Os ſacrum*, which with the two following is much ſmaller than the three ſuperior, ſoon is loſt in the *Veſica urinaria* and *Inteſtinum rectum.*

The *FIFTH* comes forward between the Extremity of the *Os ſacrum* and *Coccygis*, to be diſtributed principally to the *Levatores Ani.*

The *SIXTH* advances forward below the broad Shoulders of the firſt Bone of the *Os Coccygis*, and is loſt in the *Sphincter Ani* and Teguments covering it.

The Branches of the four laſt cervical Nerves, and of the firſt dorſal, which are beſtowed on the ſuperior Extremity, and the two

Crurals, with the Sciatic, which are diſtributed to the inferior Extremities, are much larger proportionally to the Parts they ſerve, than the Nerves of the Trunk of the Body, and eſpecially of the *Viſcera* are; and for a very good Reaſon, that in the moſt common neceſſary Actions of Life a ſufficient Quantity of Fluid, on which the Influence of Nerves ſeems to depend, may be ſupplied to the Muſcles there, which are obliged to perform ſo frequent and violent Contractions. The Size of the Nerves of the inferior Extremities ſeems larger proportionally than in the ſuperior Extremities; the inferior Extremities having the Weight of the whole Body to ſuſtain, and that frequently at a great Diſadvantage. What the Effect is of the Nerves here being leſed, we ſee daily, when People happen by ſitting wrong to compreſs the ſciatic Nerve, they are incapable for ſome time after to ſupport themſelves on the affected Extremity; and this is ſtill more remakable in the *Sciatic* or *Hip-Gout*, in which the Member is not only weakned, but gradually ſhrivels and waſtes.

THE
Syſtole and *Diaſtole*
OF THE
HEART,
And the Reciprocal Actions of its
Auricles and Ventricles
ACCOUNTED FOR.

THAT the Account I am to give of the alternate Motions of the Heart may be rightly underſtood, it will be neceſſary to mention the few following Propoſitions on which it depends.

1. All Muſcles are furniſhed with Blood-veſſels and Nerves, and their Action depends on the Influx of Blood, and of the nervous Fluid into their muſcular Fibres; therefore whenever Muſcles are deprived of a ſufficient Quantity of either one or other of theſe Li-

quors or of both, their Action is weakned or ceaſes. The Truth of this has been fully proved by the Experiments of compreſſing, tying and cutting the Nerves or Arteries of Muſcles.

2. All Muſcles are in a conſtant State of Action as long as Blood and nervous Fluid are freely ſupplied to them. This ſeems evident from the continued Contraction of the Sphincters of the Bladder and *Anus*, and of Muſcles, whoſe Antagoniſts are cut aſunder or become paralytic.

Tho' in theſe two Propoſitions, I have aſſumed a Fluid of the Nerves, for the Probability of which, ſee the Arguments in the foregoing Treatiſe, yet to avoid a Diſpute, it may be here remarked, that the following Account of the Heart's Motions, will equally hold good, by ſuppoſing the Nerves to be ſolid Cords acting by Elaſticity, Vibration, *&c.* if it is only granted, that their Action is neceſſary to the Contraction of Muſcles, and that Compreſſion is capable to hinder that Action, which Experiments plainly ſhew it is.

3. The Nerves of the Heart paſs to it between the two Auricles or two Arteries, and between the Auricles and Arteries.

4. The *Coronary* Arteries, which are the only ones that ſupply the Heart, riſe from the *Aorta* immediately above the middle looſe Part of the ſemilunar Valves, in the ſame Height of the *Aorta* as where the Angles of theſe Valves are fixed.

5. The Edges of the ſemilunar Valves are duplicated with a muſcular Corpuſcle in the Middle, and muſcular Cords running oblique-

ly from that Corpuſcle to the Inſertion of the Valves into the *Aorta.*

Theſe three laſt Propoſitions are evidently made appear to be true by Diſſections.

6. Before the Veſſels in which the Circulation is performed can act, it is neceſſary to ſuppoſe them full of their Liquors, otherwiſe the whole Vaſcular Syſtem could not be all at once put into Action, and the Motion of the Fluids ſent out from the Heart, could not be propagated to that in the returning Veſſels; conſequently the Circulation would be ſtopped almoſt as ſoon as begun.

If then both Auricles and Ventricles attempt, upon the firſt Communication of Motion, to contract; the Ventricles being ſtronger will force their own Contraction, and hinder the Contraction of the Auricles, which muſt be in the mean time much dilated by the Influx of Blood from the Veins (Prop. 6.) and at this Time, the Arteries are alſo diſtended by the Blood thrown out of the Ventricles; therefore the Cardiac Nerves lying between them, (Prop. 3.) will be compreſſed and prevented from exerting their Office. While this happens to the Nerves, the Blood ruſhing out of the left Ventricle into the *Aorta*, and thruſting the ſemilunar Valves outwards and upwards, diſtends the great Artery conſiderably, whereby the Valves are ſtretched, and their lunated Edges are brought to be ſtraight and as high as their Angles; conſequently theſe Edges, thus raiſed and preſſed to the Sides of the *Aorta*, are made to cover the Orifices of the *Arteriæ coronariæ*, which the Corpuſcles will aſſiſt to do more adequately; and therefore, while they are in this Situation, no Blood can be ſent to the Subſtance of the Heart. If then the Nerves do not exert their Office, and Acceſs is denied to the Blood, this Muſcle, the Heart muſt (by Prop. 1.) become paralytic or unactive.

The Auricles, which were attempting all this Time to contract themſelves, will now, when the Reſiſtance to them is removed, throw the Blood they contain into the Ventricles; and the Arteries that were violently diſtended while the Ventricles puſhed the Blood into them, will at this ſame Time when the Ventricles ceaſe to act, conſtrict themſelves; and the *Valvulæ ſemilunares* will, by their Elaſticity aſſiſted by the muſcular Corpuſcles and Cords, be depreſſed inwards. Since then, by the Conſtriction of the Auricles and Arteries, the Nerves of the Ventricles are freed from the Compreſſion they ſuffered while the Auricles and Arteries were diſtended; and ſince the Blood in the *Aorta* preſſed ſtrongly by the contracting Sides of this Artery, and reſiſted by the Liquors which are to be thrown through all its Branches, is alſo puſhed with great Force on the Orifice of the left Ventricle, thruſts back the ſemilunar Valves which ſtop its Entry into that Cavity, and impetuouſly ruſhes into the coronary Arteries: Since then, I ſay, the Nerves of the Heart are again free from Compreſſion, and the Blood is again ſent to the Heart by its Arteries, its muſcular Fibres muſt again contract (by Prop. 2.) And thus, as long as theſe Cauſes continue to act and ceaſe alternately, their Effects muſt be exerted in the ſame

Manner; that is, as long as an Animal lives, the Heart muſt have an alternate State of Contraction called its *Syſtole*, and of Relaxation or *Diaſtole*; and the Auricles and Arteries muſt be dilated, while the Ventricles are contracting, and the Ventricles muſt be dilated while the Auricles and Arteries are conſtricted, or their Actions muſt always be reciprocal.

THE

DESCRIPTION

Of the Human

Lacteal Sac and *Duct*.

THE *Receptaculum Chyli* of *Pecquet*, or *Saccus lacteus* of *Van Horne*, is a membranous ſomewhat pyriform Bag, two Thirds of an Inch long, one Third of an Inch over in its largeſt Part when collaſped; ſituated on the firſt *Vertebra* of the Loins to the Right of the Aorta, a little higher than the right emulgent Artery, behind the right inferior Muſcle of the Diaphragm; it is formed by the Union of three Tubes, one from under the Aorta, the ſecond from the Interſtice of the Aorta and Cava, the third from under the Emulgents of the right Side. The *Lacteal Sac*, becoming gradually ſmaller towards its ſuperior Part, is contracted into a ſlender membranous Pipe, of about a Line Diameter, which is generally named, The *THORACIC DUCT*. This paſſes betwixt the muſcular *Appendices* or inferior Muſcles of the Diaphragm, on the Right of, and ſomewhat behind the Aorta; then, being lodged in the cellular Subſtance behind the *Pleura*, it mounts between this Artery and the *Vena azygos* as far as the fifth *Vertebra* of the Thorax, where it is hid by the *azygos* as this Vein riſes forwards to join the deſcending or ſuperior *Cava*, after which the Duct paſſes obliquely over to the left Side behind the *OEſophagus*, *Aorta deſcendens*, and great Curvature of the Aorta until it reaches the left carotid Artery; behind which, and on the left Side of the *OEſophagus* it runs to the Interſtice of the firſt and ſecond *Vertebra* of the Thorax, where it begins to ſeparate from the carotid, ſtretching farther towards the left internal Jugular Vein by a circular Turn, whoſe convex Part is uppermoſt. At the Top of this Arch it ſplits into two for a Line and a half, the ſuperior Branch receiving into it a large lymphatic Veſſel from the cervical Glands. This Lymphatic appears, by blowing Air and injecting Liquors into it, to have no Valves; when the two Branches are again united, the Duct continues its Courſe towards the internal Jugular Vein, behind which it deſcends, and immediately at the left Side of the Inſertion of this Vein enters the ſuperior poſterior Part of the left ſubclavian Vein, whoſe internal Membrane duplicated forms a ſemilunar Valve that is convex externally, and covers two Thirds of the Orifice of the Duct; immediately below this Orifice a cervical Vein from the *Muſculi ſcaleni* enters the ſubclavian.

The Coats of the *Sac* and *Duct* are thin tranſparent Membranes; from the In-ſide of which, in the Duct, ſmall ſemilunar Valves are produced, moſt commonly in Pairs; which are ſo ſituated, as to allow the Paſſage of Liquors upwards, but oppoſe their Return in an oppoſite Courſe. The Number of theſe is generally ten or twelve.

This is the moſt ſimple and common Courſe, Situation and Structure of the *Receptaculum chyli* and *thoracic Duct*; but having had Occaſion to obſerve a Variety in theſe Parts of different Subjects, I ſhall ſet down the moſt remarkable of them.

The Sac is ſometimes ſituated lower down than in the former Deſcription, is not always of the ſame Dimenſions, is not compoſed of the ſame Number of Ducts, and frequently appears divided into ſeveral ſmall Cells, inſtead of being one ſimple Cavity.

The Diameter of the Duct is various in moſt Bodies, and is ſeldom uniform in the ſame Subject; but frequently ſudden Enlargements or *Sacculi* of it are obſervable. The Diviſions which Authors mention of this Duct are very uncertain. I have ſeen it divided, and one Branch climb over the anterior Part of the *Aorta* at the eighth *Vertebra* of the *Thorax*, and at the fifth ſlip behind that Artery, to join the other Branch which continued in the ordinary Courſe. The preciſe *Vertebra*, where it begins to turn to the left Side, is alſo uncertain. Frequently it does not ſplit at its ſuperior Arch; in which Caſe a large Sac is found near its Aperture into the ſubclavian Vein. Generally it has but one Orifice; tho' I have ſeen two in one Body, and three in another: Nay ſometimes it divides into two, under the Curvature of the great Artery; one goes to the right, another to the left ſubclavian Vein; and I have found this Duct diſcharging itſelf entirely into the right ſubclavian. The lymphatic Veſſel which enters its ſuperior Arch is often ſent from the *thyroid* Gland.

Whether is not the Situation of the *Receptaculum chyli* ſo much nearer the muſcular *Appendices* of the Diaphragm in Men than Brutes, deſigned to ſupply the diſadvantageous Courſe the Chyle muſt otherwiſe have in our erect Poſture?

Does not the Deſcent of the Extremity of the Duct to the ſubclavian Vein, and the opening of the lymphatic into the Top of the Arch, contribute to the ready Admiſſion of the Chyle into that Vein?

FINIS.

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